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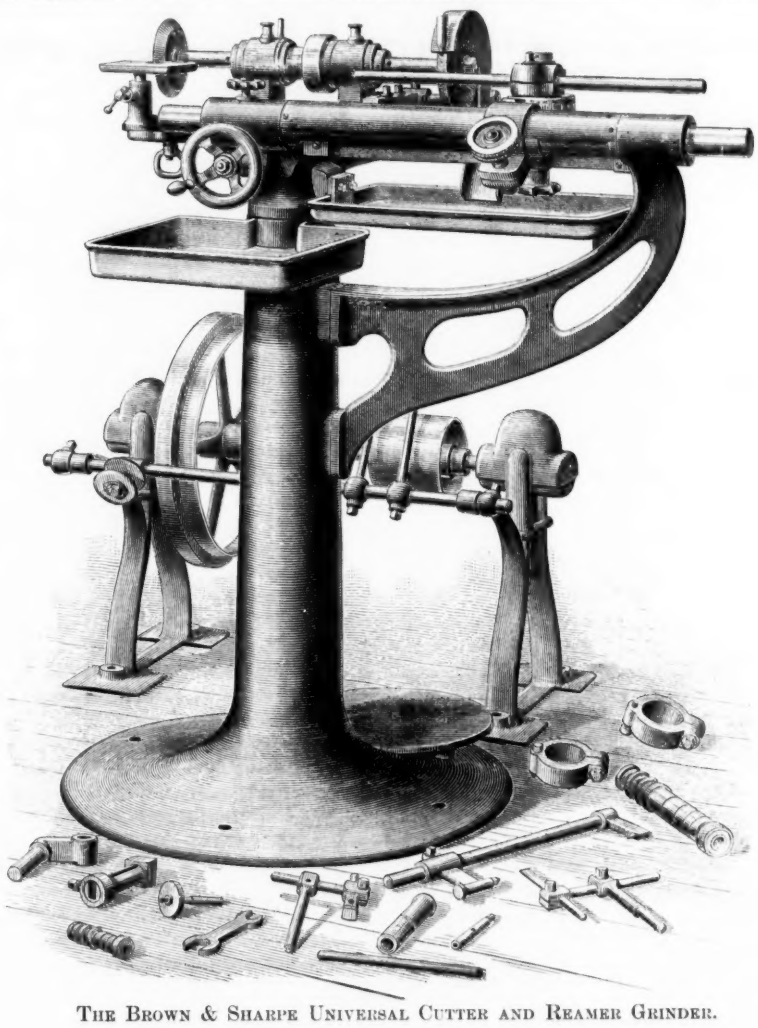
ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

The Brown & Sharpe Universal Cutter and Reamer Grinder.

This machine, which we illustrate, together with a few of the uses to which it may be put, is one recently designed by the Brown & Sharpe Manufacturing Company, Providence, R. I. It is especially adapted for use in tool-making shops, and in jobbing and manufacturing shops where means for rapidly and accurately sharpening a large variety of tools are required. To this end it is so constructed that any special fixture likely to be necessary or desirable for a special purpose, may be used with it, and is thoroughly and substantially made to withstand continuous use.

The spindle is of steel, hardened and ground. It has two speeds, and runs in boxes adjustable for wear and protected from the entrance of dust and dirt. End adjustment of spindle is also provided. In each end of the spindle is a taper hole for a wheel arbor, the holes being ground true.



THE BROWN & SHARPE UNIVERSAL CUTTER AND REAMER GRINDER.

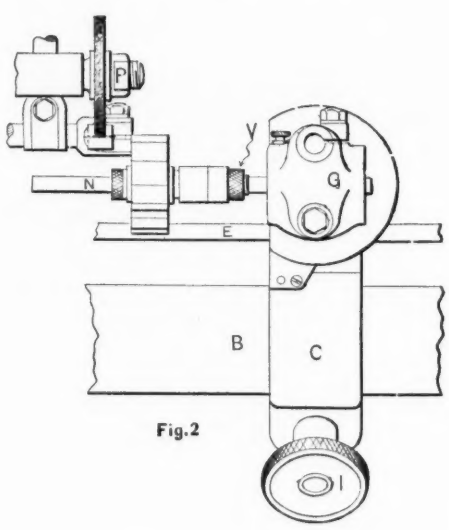


Fig. 2

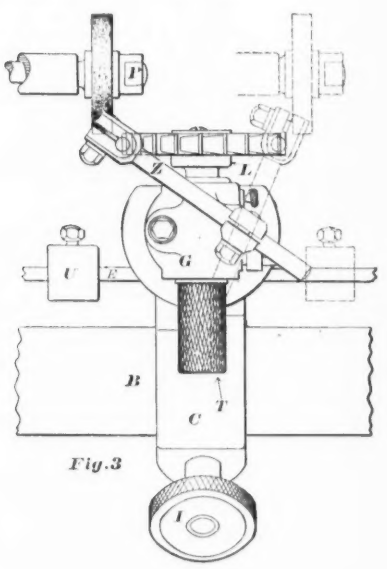


Fig. 3

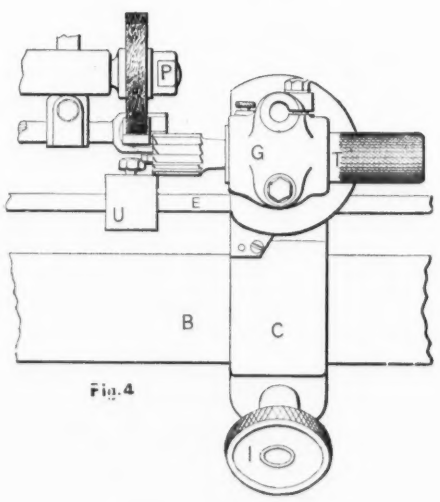


Fig. 4

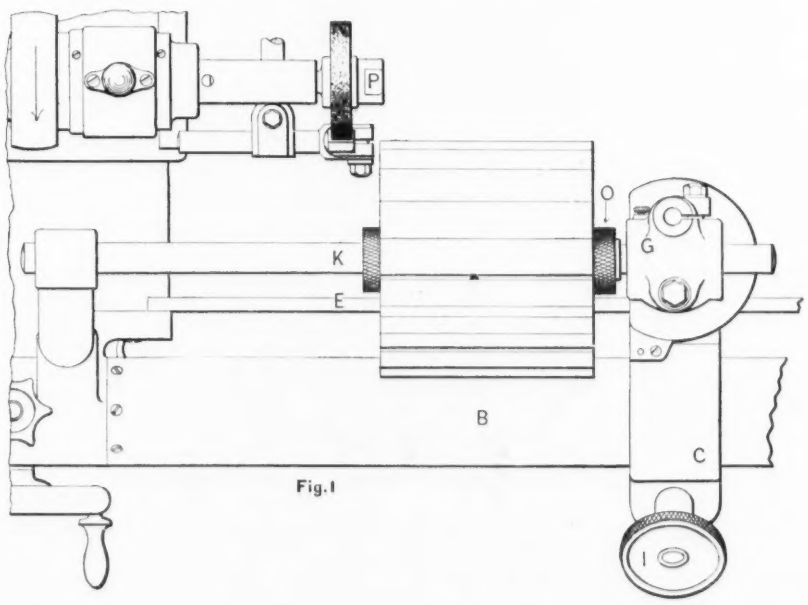


Fig. 1

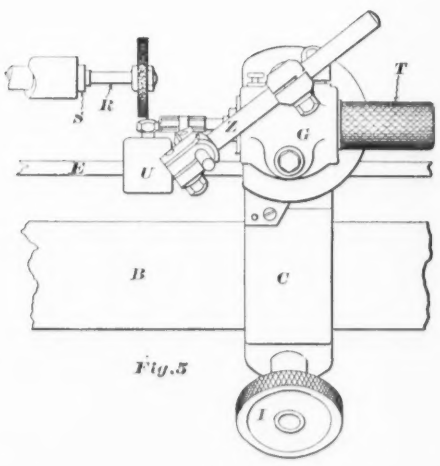


Fig. 5

The main bar *A*, Figs. 11 and 13 (page 2), is of steel, ground for its entire length, and protected from dust by the shield *B*. This bar is arranged so as to be readily removed for cleaning. When this is to be done it is only necessary to loose the binder *I*, which leaves the bar free.

The slide head *C*, Figs. 10 and 11, is provided with a hardened pin *D*, which rests against the hardened and ground guide-bar *E*, making its action very smooth and regular. When grinding this head is clamped to the main bar *A*.

The swivel head *G*, is graduated to 180°, and is adjustable by means of screw *H*, for any desired clearance.

The figures from 1 to 13 represent some of the plans that may be adopted for holding different pieces for grinding. They are not given as illustrating the range of capacity of the machine, nor as the only practicable manner of holding the pieces represented. In this latter respect the workman may often substitute ways of his own, while plans to be pursued in the instance of forms not shown or referred to will readily suggest themselves.

Fig. 1 represents the grinding of common mills up to 6″ in diameter and length, either straight or spiral cut. The machine may also be used as represented here for nicking saws, grinding straight shell reamers, and for all analogous purposes. Fig. 2 represents the arrangement for similar work of smaller dimensions.

In Fig. 3 is represented the arrangement of the machine for grinding the sides of straddle mill of any size, also face mills with or without shanks.

Figs. 4 and 5 show how the sides of shank mills may be ground, also edging or profiling cutters, Fig. 5 showing the small arbor and wheel in use for very small mills.

Fig. 6 indicates the manner of grinding bevel cutters, and Fig. 7 taper cutters or shell reamers.

Straight and taper reamers may be ground as shown in Figs. 8 and 9. An end view of these figures is shown in Fig. 10, representing the use of the stationary rest *Z*, which is secured to the center bar. The rest *Z*, is used only when the flutes are straight. When not cut straight, a rest secured to the spindle head is used.

Fig. 11 illustrates the grinding of thread or worm tools for either right or left-hand work, the proper angle being obtained by means of the graduated swivel head. By this means such tools can be readily ground to correct angle, and with the necessary clearance.

Fig. 12 shows the relative position of wheel and taper work, and Fig. 13 illustrates the manner of sharpening the Brown & Sharpe gear tooth cutters.

Another important attachment to this machine—the end grinding head—used for recutting and sharpening hollow and end mills, facers, sides of straddle mills, counterbores, etc., without annealing, will be shown in a future issue.

The machine is very finely constructed, and furnished with a large variety of attachments for holding and doing work, consisting in part of center for holding reamer,

shown at *J*, Figs. 8, 9, and 10; cutter bars, shown at *K*, Figs. 1 and 7, and *N*, Fig. 2; thread and worm tool holder *M*, Fig. 11; cutter shells, with collars and nuts, to take all sizes holes from $\frac{1}{2}''$ to $1\frac{1}{4}''$, shown at *O*, Fig. 1; arbor for straddle and face mills, *L*, Figs. 3 and 6; right-hand wheel arbor *P*, Fig. 1; left-hand *E*, Figs. 13, 14, and 15; small wheel arbor *R*, Fig. 5; collet *S*, Fig. 5; taper shank mill bushing *T*, Figs. 4, 5, and 6; two slide hand stops *U*, Fig. 3; two main bar stops *W*, Fig. 11, together with keys, wrenches, and a variety of emery-wheels, etc. The countershaft has 6″ tight and loose pulleys for 2″ belt. Weight of machine 675 pounds.

The fortieth meeting of the American Institute of Mining Engineers will be held in Philadelphia, beginning September 2d. The new secretary is R. W. Raymond, 13 Burling Slip, New York. The society is a very large one and is rapidly increasing its membership.

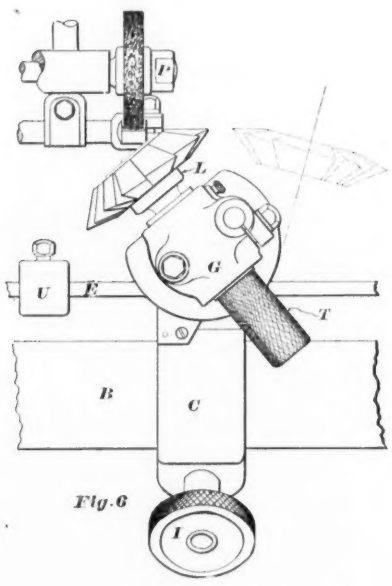


Fig. 6

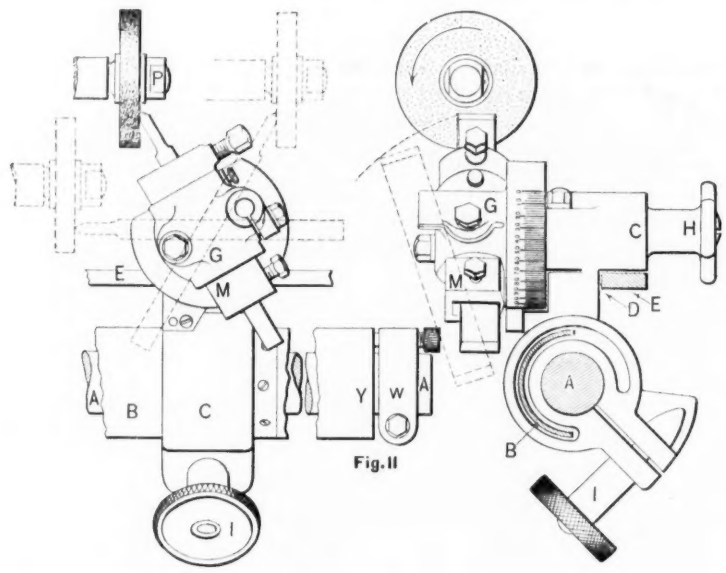


Fig. 11

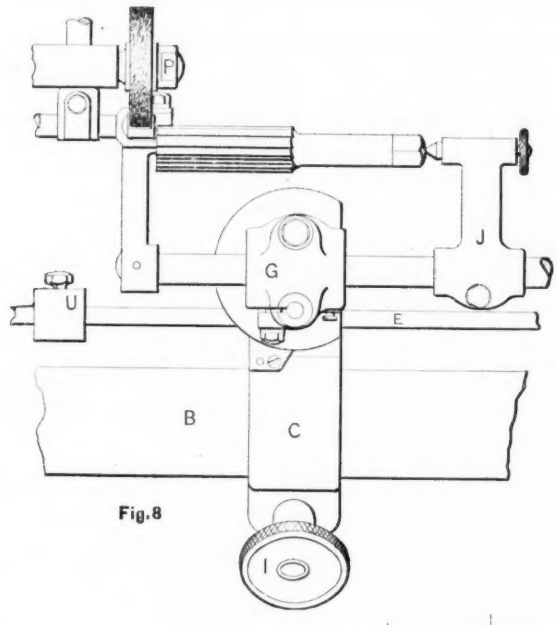


Fig. 8

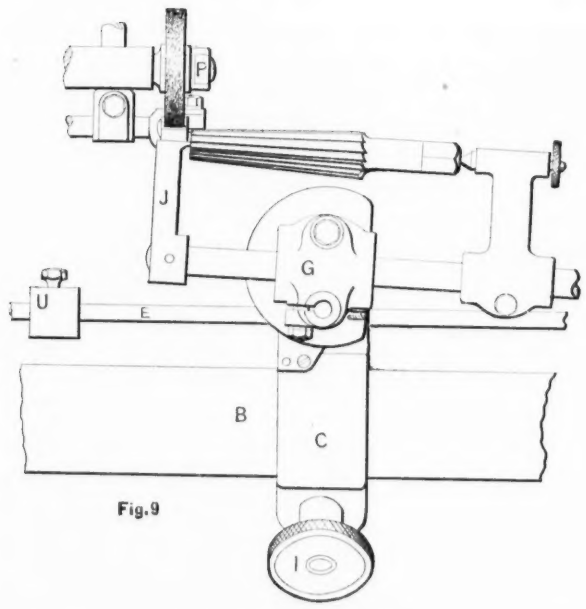


Fig. 9

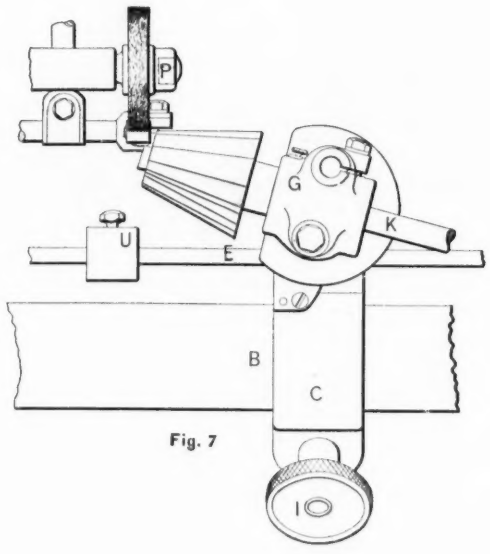


Fig. 7

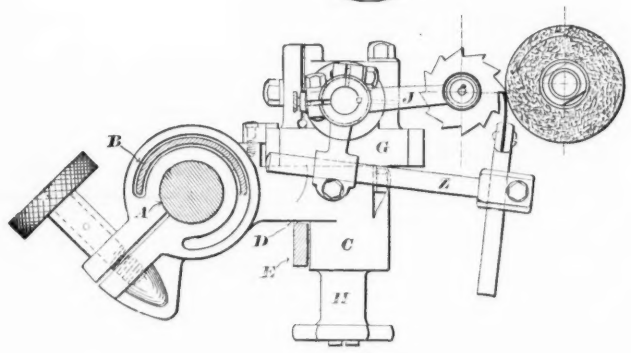


Fig. 10

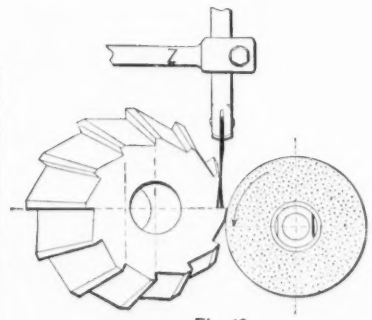


Fig. 12

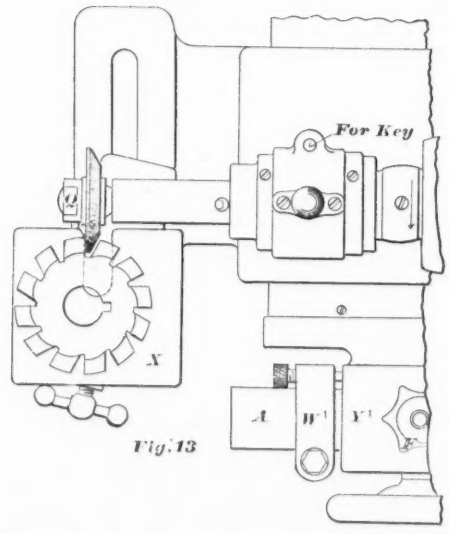


Fig. 13

Speaking of iron-workers' wages in England, the *National Labor Tribune* says: "In 1868 the puddler was paid seven shillings and sixpence per ton of 2,240 pounds. Arbitration raised the price to eight shillings per ton. It stood there but a short period of time. In 1879 the price reduced to six shillings and sixpence per ton, the present price. In 1880 the price per ton was seven shillings and ninepence, and from that time the price per ton for puddling has been fluctuating between the last price named and six shillings and sixpence, the present price. Between arbitration and free trade, the English iron workers are having a hard time."

A Novel Southern Enterprise.

We are informed by C. A. Hege, of the Salem Iron Works, of North Carolina, of a novel enterprise now well under way at that place. Near the coast of many of the Southern States are large quantities of cypress timber, of the finest quality, which, owing to its nature, cannot be successfully rafted. The enterprise referred to is to cut this timber on a boat especially arranged for the purpose, and for which Mr. Hege is to furnish the machinery. The boat will be supplied with the necessary engine power, and with a 70 feet double and a 50 feet single saw-mill, a direct-acting steam gang mill, with edgers, cut-off saws log turners; in fact, with all modern appliances for expediting work, and thus equipped will proceed along the coast of North and South Carolina, Georgia, and Florida, cutting lumber along the route. The timber can be bought cheap, and the experiment, if successful, will be of considerable importance.

General History of Stationary Steam Boilers.

BY WILLIAM LOWE.

THIRD PAPER.

ADAPTABILITY OF BOILERS FOR THE SEVERAL KINDS OF FUEL.

For light bulky fuel, such as sawdust, shavings, and chips, or refuse of like character, those boilers with external furnaces are the best, because this fuel requires large and roomy fire-brick furnaces to produce the best combustion and avoid firing too often. If, however, the brick external furnace is connected with the boiler in such a manner that the heat from it passes directly through the internal heating surfaces first, there will be better results from the fuel; or if an internally fired boiler has a large furnace, suitable for this fuel. Good results are obtained in internal furnace boilers fed with straw automatically, as in the portable locomotive type of boiler, used for driving threshing machines. Shavings from planing mills are now fed to the furnaces of boilers automatically, with good results. Mixed fuels are used largely of late, and are burned to best advantage in brick furnaces, although as good, or even better, results may be obtained in suitable sized internal furnace boilers, properly adapted to this fuel. I know many parties who use this kind of boiler with this fuel, and other light fuels, and will use no other type of boiler, having satisfied themselves that these boilers produce the best result from their fuel.

I know cases where return tubular boilers and internally fired boilers are run side by side with sawdust and light fuels, and the preference is given to the internally fired boiler, because it shows the most work from this fuel. With boilers of the cylindrical form, same as the Cornish, Lancashire, Galloway, and drop-flue types, light fuels cannot be burned properly, because the furnaces are too shallow, but if a furnace was built under these boilers of suitable size for this fuel, and the heat passed directly through the internal heating surfaces first, and returned under the boiler, as good results would be obtained as with any other boiler.

We now come to the consideration of coal and coke fuels. The anthracite coals are burned satisfactorily in any well-proportioned furnace, either external or internal, and so is coke, but the bituminous coals require deep and large furnaces, properly supplied with air, over the fuel, to get the best effect from them.

ECONOMY OF FUEL IN BOILERS.

On this subject there are about as many different opinions as there are kinds of boilers, and as a man will not be convinced against his own interest the makers of the several kinds of boilers assert that the boilers they make will get the most effect from the fuel. Then we have the patent furnaces, the owners and makers of which claim that the best results in economy of fuel can only be obtained with their furnace, and if it cannot be applied to any type of boiler, they insist, or rather are obliged to insist, that an inferior boiler to which they can attach it will produce a large saving of fuel, and so the user who is not posted must place his confidence with some one to judge for him, and it is ten to one whether he does not place it where self-interest rather than facts, or good sound reasoning, will be used in advising his purchase. Many boiler manufacturers and mechanical engineers assert that they can get as much result from the fuel and outlay with the simple return tubular boiler, externally fired, as they can with the best type of internally fired boilers, when taking into account the difference in first cost and interest on same and difference in cost of maintenance and length of life of the boilers. I know this to be an erroneous conclusion, because a five per cent. saving of fuel at ordinary prices will amount to the price of the best boiler in less than half its life. This saving (and more) can be obtained with a good, well-proportioned internal furnace boiler against any external furnace boiler set so that the heat passes under it and returns through the internal heating surfaces, under equal conditions. The reason for this is on account of the greater loss of heat through the walls of the externally fired boiler, over the internally fired one, both when doing the regular work and while standing with banked fires, day or night, or in making new fires every morning, and in the greater effect of the heat passing

from the furnace directly through the internal heating surfaces of the boiler; or, in other words, heating water first and brickwork last. It will readily be seen that the losses by radiation, through the brickwork, are pro rata to the temperature of the heat confined by it, and as in the case of the externally fired boiler, the furnace is really all the space inclosed by the brick walls and upon which the full heat of the furnace is applied, it will be seen, that there must be great loss through radiation. This loss is called insignificant by those whose interest it is to have it so, but reliable authority puts the loss much greater than I am willing to believe; some of the largest steam users in the world have proved it to be so great that they will not use boilers other than those in which the heat from the furnace is applied to the internal heating surfaces first and to the brickwork of the setting last. Again, there will be a better quality of steam for engine use from any boiler of the internally fired type, because there is greater heat near the water line than in the internally fired boilers, and it is a well-known fact that all boilers of the regular internally fired type give the dryest and most serviceable steam, because the hotest gases are nearest the steam space and the coolest at the bottom—just as it should be to have the boiler steam easily and quietly, when all the proportions are right. This is exemplified in the fact that all internally fired boilers produce the most effect from the fuel under equal duty pro rata to the heating surface, and I defy anyone to show an instance where this is not true, with any regular, well-proportioned boilers of either kind, set in competition under equal conditions.

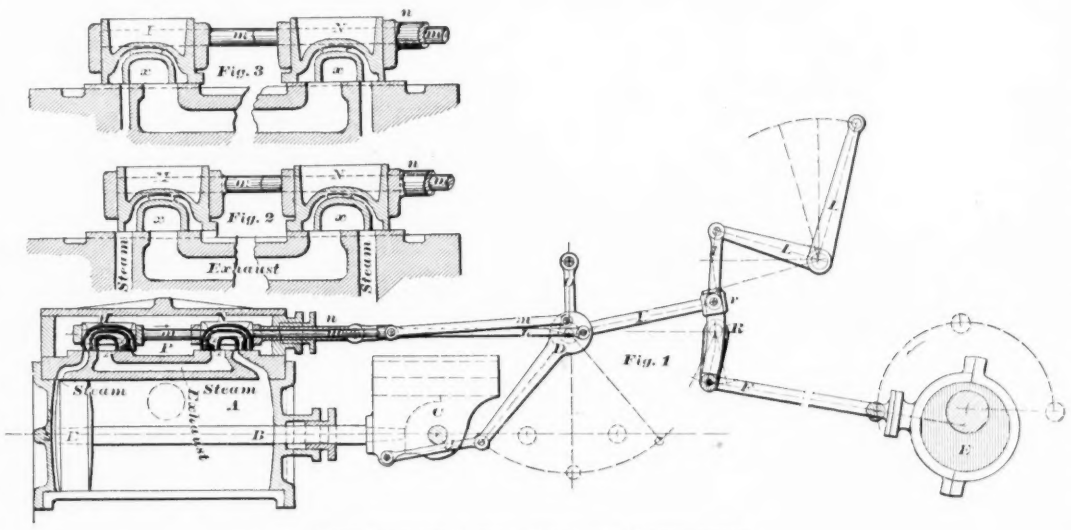
FURNACES FOR BURNING MIXED OR OTHER LIGHT FUELS.

This is a subject that needs more investigation, because of the liability of boiler users being deceived by the representation of those engaged in advocating the use of their inventions for burning fuel. There are many patented constructions of furnaces for this purpose, and many attachments and mechanisms for burning these fuels, but I do not know of any case in which, with any furnace or mechanism of whatever kind, more result has been obtained from any fuel, or mixtures of coal with other fuels, than with the internal furnace boilers properly fitted for these fuels, under equal duty pro rata to the heating surface, and all other conditions being equal, including capacity of draft. Yet it is claimed that there is great saving of fuel of all kinds with these contrivances, and I have before me a circular which says, in plain English print, three boilers set in this way will make as much steam as five set the old way. It is possible that those who issued this statement believe it can be done, but I believe it was made to attract customers, and without any facts to prove it.

The statement, that any type or system of boiler, set in the usual way, and with the ordinary appliances for burning the best of any kind of fuel, and having a properly-proportioned flue and chimney, can be made to do more work with any inferior fuel, or do the same work with ten per cent. less of the best fuel, is extremely doubtful and should be carefully investigated. In burning cheap or mixed fuels, the saving in cost of fuel for the work done, over that with good or best fuel, depends entirely upon the cost of the quantity of the mixture that will do the work that the good fuel must do, in a given time, in the same boiler, because it is not an equal condition to give the cheap fuel the advantage of larger boiler capacity; but I know it must be done, or there will be no saving in cost of fuel, that is with natural draft.

The amount of work done by a boiler in a given time depends upon the quality of the mixture, so that it is impossible to do as much work in a given time (in same size boiler) with inferior fuel and same draft, so it will be seen that to get cheap steam the boiler capacity must be large enough to give time to burn whatever fuel there is in any mixture of fuels, with natural draft and also with a blast; but with the blast the object of the large boiler capacity is to reduce the strength of the blast, so as to prolong the life of the boiler, for it is well known that the shortest-lived boiler is one that is made to do too much work, with cheap fuel and a blast. Any cheap fuel mixed with soft or bituminous coal can be burned in an ordinary furnace having a good natural draft, and a proper supply of air through the furnace door, or other suitable opening, because the soft coal expands with heat and opens the fuel so that the air can penetrate it through the grate, to burn the carbon properly, and the air supply over the fuel will burn the gases.

There are several plans of furnaces that burn mixed and other cheap fuels very satisfactorily, and perhaps some do better than the ordinary furnace, but their construction and auxiliary attachments soon get deranged, and worn out, and unless they are kept in good order any saving by them is soon lost, and the saving is very small with boilers that must do their fair rating of work, with best and as cheap a fuel as will do it; because, in order to make a boiler do its fair rating with cheap fuels, the rate of combustion of the cheap fuels must be forced to that extent that there is great waste of it, and moreover the mixture must have a higher cost than with larger boiler capacity. The cheapest steam is obtained from the cheapest fuel and a blast, the next with natural draft and large boiler capacity, with cheap mixtures of soft coal with other fuel, but the most satisfactory results, in all respects, are only obtained with good fuel and large boiler capacity, under good and reliable natural draft.



THE STEVENS VALVE GEAR FOR LOCOMOTIVES.

The Stevens Valve Gear for Locomotives.

We are indebted to the inventor, A. J. Stevens, General Master Mechanic of the Central Pacific Railroad, office at Sacramento, Cal., for the following description of this valve gear:

The valves are located upon either end of the cylinder, so that the steam passages to the cylinder may be very short. In Fig. 1 the valves have two passages through them, one for admitting and one for exhausting steam to and from the cylinder; the steam is also admitted and exhausted in the usual way. These valves are upon the Wilson principle. We do not use them at present, however, as I have designed another valve, which is shown in Figs. 2 and 3. The latter resembles, somewhat, the Allen valve, with this difference—steam is admitted and exhausted to and from the cylinder through the same passage. This valve also takes steam and exhausts in the usual way, so that we get the steam into the cylinder doubly and exhaust it from the cylinder doubly.

This arrangement will be understood from an inspection of the engravings, without further explanation. These valves are worked by one eccentric, the eccentric giving both the forward and backward motion. The eccentric is set at the proper angle to the crank to drive the engine in both directions—forward and backward. For the reversing motion of the valve. we use a curved rocker arm, shown at *R* in engraving, with a sliding block upon the same. Attached to the sliding block is a link, which is also attached to the lap and lead lever; the lower end of this lever is attached by a link to the cross-head, from which it receives its oscillating motion. This lever is suspended by a hanger to any convenient part of the engine. Projecting from one face or side of this lap and lead lever are two pins, to which are attached one end of the valve stem by means of connections or links. These pins are set upon the lever at points between 90 and 180 degrees apart, so as to give a differential movement to the valve which cannot be obtained when the pins are set opposite on the lever.

Each valve has its own rod and separate connection with the lever. In most instances the stem of the back valve is made hollow, and the stem of the forward valve is passed through it, so as to avoid the use of more than one stuffing-box upon the steam chest; but we have in several instances fitted them up with two stuffing-boxes, the separate valve stems working side by side. The valve being coupled up in this manner by independent rods to the lap and lead lever, they will move together and in the same general direction from the action of the eccentric. But besides this movement, common to both, each valve is controlled and acted on by the angular position of the two pins, which results from the rotary or oscillating movement of the lap and lead lever upon its center, and each valve, instead of having a uniform rate of travel, has a variable movement. The degree of this variable movement is governed both by the distance of the pins from the center upon which the lever works and the length of the lever, and can be increased or diminished by changing the position of one or the length of the other in construction. The horizontal movement of the valve received from the lap and lead lever while the same is at mid-travel, is very slight, while the piston or the cross-head is traveling very rapidly. By this slow movement of the valve, steam is retained in the cylinder until the piston has nearly completed its stroke, and, on the other hand, the exhaust is kept open. As the cross-head approaches either end of the stroke the action of the valves is very much accelerated, receiving, as they do, their motion from the combined action of the lap and lead lever and the eccentric.

The exhaust lead is controlled by the pin in the lap and lead lever, which is on the center, or horizontal, when the cross-head is at either end of the cylinder. The steam lead is controlled by the pin that is vertical, or above the center of the lap and lead lever, when the cross-head is at either end of the stroke. Both steam and exhaust lead are uniform at all points of cut-off. By this arrangement of the valve gear and valves, steam can be cut off at any point of the stroke (by moving the sliding block toward the center of the rocker arm) and is retained, if desired, to the last inch of the stroke. In receiving, the steam is evenly distributed at all points of the cut-off.

There are about as many pieces to this gearing as to the ordinary link gear, but it is considerably cheaper in construction, and much more durable, while we do away with two eccentrics and their straps and connections.

The assessed value of Abilene, Texas, is $1,400,000. Three years ago there was only a wilderness where the town now stands.—*Houston Post.*

The remarkable success of the Southern Exposition of 1883, toward which the people of Louisville, Ky., contributed nearly one half million dollars of their money, has induced them to subscribe over a quarter of a million dollars more for the purchase of grounds and improvements for an exhibition in the same building this year.

At the Worcester Free Institute of Industrial Science, Worcester, Mass., a class of 24 young men was graduated June 26th. Among the subjects of essays by the graduating students were the Porter-Allen Engine, History of Aniline Manufactures, Turbine Water Wheels, the Armington and Sims Engine, Railway System of the East River Bridge, Bridge Foundations, Recent Improvements in the Manufacture of Steel, the Westinghouse Engine, Railway Signals, Compound Engines, A New Type of High-Speed Compound Engine, Pneumatic Sewerage with Separate System, the Coloring Matters Derived from Coal-Tar, Uses of Iron and Steel in Bridges, the Emery Testing Machine, Reservoir Walls, Electrical Measurements for Commercial Purposes, Water Supply of Cities, Water Gas, the Straight-Line Engine. These subjects show that the students have been giving their attention to practical progressive engineering.

The United States produces 22 per cent. of all the pig iron made in the world, 27 per cent. of all the steel, and 24 per cent. of all the coal, and she consumes a still greater proportion of these products.

These are hard facts for the free traders to face. The *Evening Post* frantically calls out that our manufactures "have been built up higher and more topheavy than most of us would like to see them." The *Post* wants the tariff cut down so that some of them can fall. True Americans hold that so long as we consume more iron and steel than we produce there is no real overproduction; and again, that so long as we have abundant raw material and labor to produce all the iron required at home there is no need to import them from abroad.

One of the provisions for exhibitors at the World's Centennial and Cotton Exposition at New Orleans is, "Exhibitors are entitled to insert, after their name or the name of the firm, the names of their assistants of every class and grade who may have taken part in the production of the goods exhibited." This is a wise and liberal provision, and we hope to see it generally acted upon by the establishments which send goods to that Exposition. It won't hurt the reputation of any manufacturer to give full credit to his foreman and workmen for the results achieved. Such credit is too often withheld. The ambitious young mechanic takes pride in his work, and proper recognition and encouragement should be given him. Let the New Orleans Exposition mark an advance in this respect.

Some experiments that would settle with reasonable definiteness the loss of heat through the brickwork of ordinary boiler setting would be valuable. There are great differences of opinions on this subject, and careful experiments are needed to settle them.

Improved Lever and Screw Feed Lathe.

Fig. 1 shows this lathe complete, and Figs. 2 and 3 details of the lever and screw feed. The arrangement is a very convenient one, being such that the lever feed can be used at any time without disconnecting the screw and wheel. The manner of accomplishing this may be seen by referring to Fig. 2. As will be seen, two spindles are used, one inside the other. On the outer spindle a rack is cut, in which a gear section, operated by the hand-lever, works. Moving the lever moves both spindles.

When it is desired to use the screw the binding nut is turned down, binding the outer spindle, the inner spindle then being operated exactly as in an ordinary screw feed spindle. When the lever is not in use it may be swung over to the back of the machine, as shown in Fig. 3.

These lathes are made 10″, 13″, and 16″ swing, with driving shaft underneath, or countershaft overhead, as desired. An improved belt-shifting device is furnished, and a swinging tool-box, which can be swung out or underneath the table when not in use. These lathes are also made, when desired, without the lever attachment, and either with legs or for mounting on bench. A slide-rest is furnished with them, if wanted. They are made by the Diamond Emery Wheel and Machine Company, Providence, R. I.

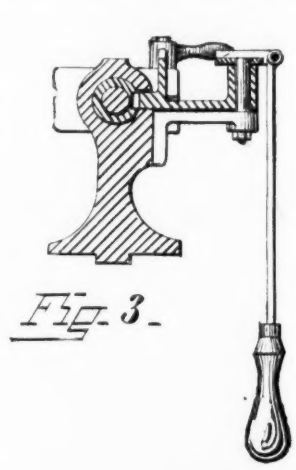


Fig. 3.

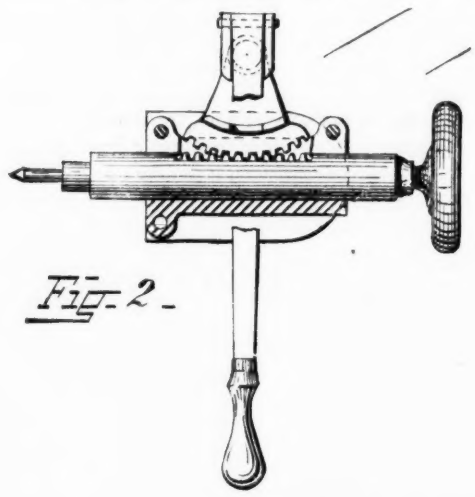
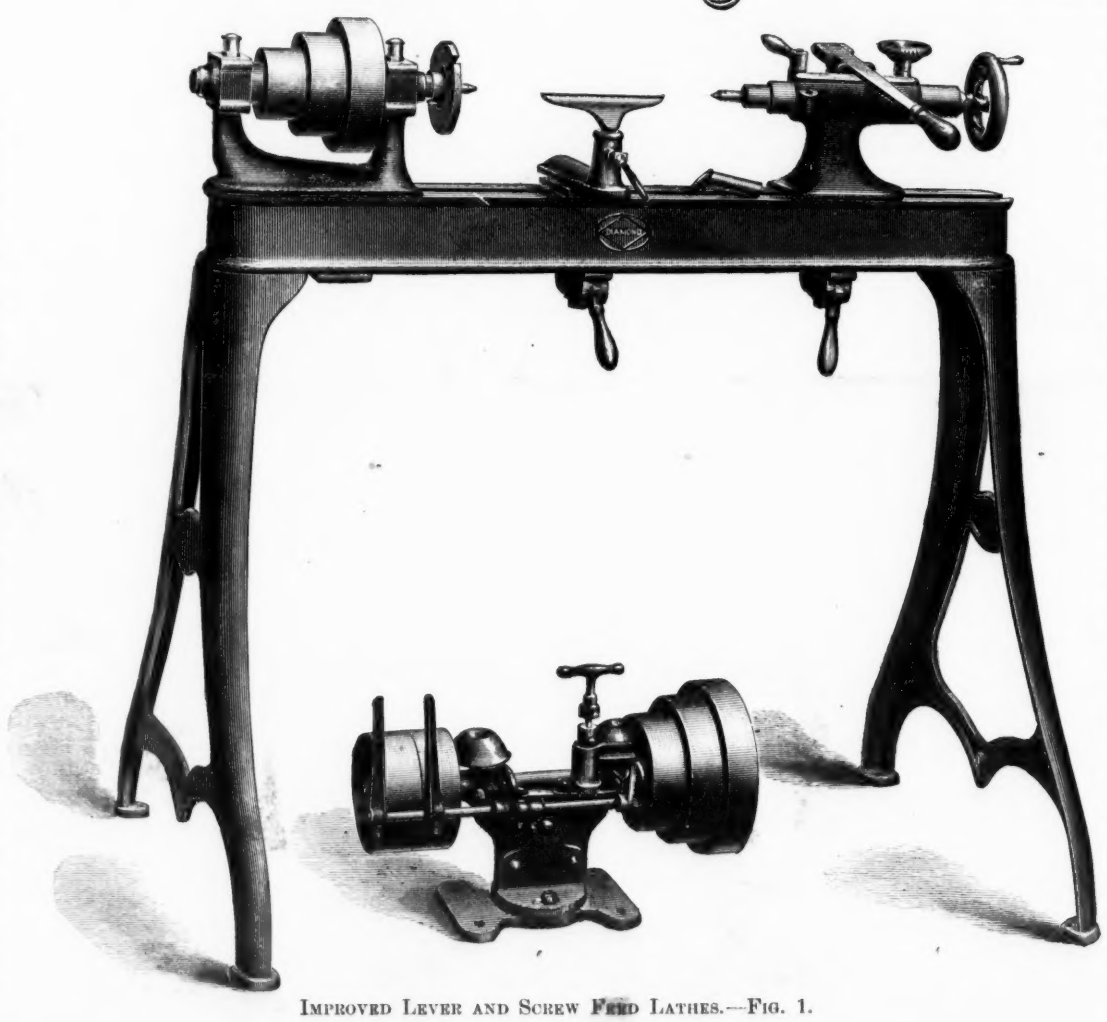


Fig. 2.



Improved Lever and Screw Feed Lathes.—Fig. 1.

A Ship Brake.

A device called a steamer's brake is coming into favor with vessels trading on the inland lakes. It is a rig consisting of two wings of boiler iron placed at the ship's stern under the water, one wing being at each side of the rudder and standing parallel to the latter. The means of operating this brake are placed in the wheelhouse. When a necessity for suddenly stopping arises, the wings are pushed out at right angles to the vessel's motion and held in that position. The in creased resistance due to this body being pushed out at right angles operates to reduce the speed quickly, and the device is found very convenient in many cases. It can also be used to aid the rudder to turn a vessel quickly, as one wing can be pushed out while the other remains in its normal position.

Thomas Mullery, 998 Third Avenue, New York City, has invented and patented a steam ice yacht, which he designs not only for pleasure purposes, but for service in carrying passengers in some parts of the conutry. Mr. Mullery has evidently given a good deal of thought to the subject.

LETTERS FROM PRACTICAL MEN.

Comparisons of Different Types of Boilers.

Editor American Machinist:

Replying to George Marshall's statements and criticisms of my article on the money value of steam boilers, in your issue of July 19th, I desire to say that I believe there is no doubt that he is wrong, both in his specific and general statements, as follows: In that the horizontal return tubular boiler has a longer life than the mentioned types of English boilers under the same conditions; in the amount of heating surface and power of a 7 ft. by 30 ft. Lancashire boiler, and the space required to set the power, as compared with the return tubular boiler; in the pressures carried upon English boilers and those in this country at the present time for high-pressure engines generally, or for compound engines; in that boiler explosions are no more frequent in this country than in Great Britain; in that English authorities do not claim greater efficiency, durability and economy for the use of their type of boilers than we claim for the return tubular; in that with English types of boilers mentioned their increased cost is largely owing to the difference in thickness of plates required, compared with the return tubular boiler; in the comparison of space and cost of setting same amount of power in the two systems of boilers in question; in that my statements in regard to the efficiency of the heat in the internally-fired boilers cannot be fully accepted.

On the foregoing I have to say that, in comparing the endurance or wear of boilers with each other, the same power in each kind must be considered, and the effect of the heat and kind of water upon them, for same amount of evaporation for a number of years, say, their reasonable life. For instance, a 7 ft. by 30 ft. Lancashire or Galloway boiler has about 850 feet of heating surface when set. This, at 10 feet per horse-power, would give 85 horse-power (not 47), and will do easily, and with a satisfactory amount of fuel (either hard or soft coal), 100 horse-power. In these boilers no damaging heat reaches the shell of the boiler, either sides or bottom, because the fire is in the internal furnace, the heat from which must pass over the internal heating surfaces first, which so reduces its temperature that it cannot damage the shell in its passage over it, on sides or bottom; and, as the heating surfaces in both furnaces and flues are cylindrical, there is not so much liability for the lodgment of scale-forming deposits as upon other forms of heating surface, and, as all parts of this type of boiler are accessible for men with scaling and cleaning tools to thoroughly clean and repair them when needed, they can be kept in good order, and retained in use till they are entirely worn out. Some of these boilers were shown the writer in England in 1878, which had been in use from twenty-five to thirty years, at very little cost for maintenance in repairs. In comparing this type of boiler with a 100 horse-power return tubular boiler, which would be 5½ ft. by 16 ft, with shell of ⅜ thickness of iron plates of 50,000 lbs. tensile strength for a pressure of 75 lbs., same as would be carried on the 7 ft. by 30 ft. English boilers mentioned having ½ plates in shell, of same iron, we find that, according to the rules and regulations of this Government on boilers they control, the 7 ft. boiler, with double riveted shell, would be allowed to carry 118 lbs., and the 5½ ft. 113 lbs. pressure. Comparing their wearing qualities, we find that the shell of the return tubular is simply a kettle of water set over the fire and subjected to its full heat. The bottom of this size boiler generally is not more than 20 to 24 inches above the grate, and while working not more than 12 to 16 inches from the fire. In this boiler the evaporation precipitates the most of the impurities of the water upon the plates over the fire, because there is where the most evaporation takes place, and where there is the most liability for the fire to damage the plates, if not kept quite clean and free from scale and other deposits. Every one conversant with this subject knows that this is a source of much trouble and expense in this type of boiler, and that all attempts, so far, have failed to protect this type of boiler from this liability with any but the purest water and care, and the difficulty to protect them from this liability is increased by their inaccessibility for thoroughly cleaning the shell from scale. As for the tubes, they cannot be cleaned at all, and they must take their chances for length of life according to the conditions which gauge their length of life, or the time when they must be removed to clean the shell thoroughly and put new tubes into it; and, as the cost of the tubes is a large portion of the cost of this type of boiler, the cost of maintenance in good economical working order is much greater than the other types of boilers mentioned, because in them the furnaces, flues and internal parts are of a thickness proportioned to their diameters, and their forms and position are such that the precipitants from the water cannot so easily lodge upon the heating surfaces and form damaging scale. Also that which does lodge and adhere is accessible for comparatively easy removal by scaling tools, and that deposit which falls below the furnaces and flues into bottom of boiler is also easily removed, and does not damage the shell of the boiler, if quite foul, for reasons given above.

These are the reasons why the Cornish, Lancashire and Galloway boilers have the longest, and the return tubular boiler the shortest, life. The Government has, in its rules, limited the thicknes of shells of boilers, which are subjected to the direct heat of the furnace, to .26″ thickness, because of the liability of thicker plates to be damaged, as stated above, and the boiler shell made dangerous by weakening from this cause. The officials have, however, permitted the use of thicker shells in similar boilers for marine use as an experiment, which has not yet had sufficient time to determine the results of this deviation from the rule.

In regard to the space required for setting these two types of boilers, the return tubular would require 8½ ft. by 19 ft., and the 7 ft. by 30 ft. 10 ft. by 33½ ft. for 100 horse-power in each type, but the difference in space occupied by the return tubular boiler is the only advantage it has over the others; and when reliability, endurance and economy of fuel are considered, this advantage has no real value, excepting in cases where the room for the power is absolutely limited.

I have not time to look up statistics of explosions of boilers in this country and Great Britain, but I will venture to say that we have two here to one there, or in continental Europe, of the same number of boilers under same conditions, and in these countries the English type of boiler predominates. Of over 10,000 boilers cared for in Great Britain, by one of the inspection and insurance companies, 83 per cent. are internally fired, not counting locomotive engine boilers. On the statement that English authorities do not claim greater efficiency, durability and economy for their types of boilers mentioned, I have to say that the most prominent users and makers laughed at the writer when he made the statement to them, that the return tubular boiler so extensively used in this country was considered equal to their types of boilers mentioned in every respect. They said they knew better, and could not afford to use this boiler, and that the extra space occupied and extra cost of the boilers was a profitable investment, and land, I should think, anywhere there is as dear as here. The difference in first cost of these boilers mentioned, over the return tubular of same capacity, is due to the extra cost of construction and size, as well as weight of theirs, over the tubular, to get the required heating

surface in plates to compare with the heating surface in the tubular boiler.

In regard to the possibility of making a condenser of a part of a boiler, all you have to do is to burn so little fuel in it, and do so little work, with any kind of a boiler, that the temperature of the escaping gases will be lower than that which will produce evaporation on all the heating surfaces under the pressure carried upon the boiler. The effect of this very unusual condition would be more damaging to the economy of fuel in the tubular than in either of the other types of boilers, because the cooled gases in the tubular are returned through the hottest part of the boiler, while the reverse is the case in the other boilers; so it will be seen that the cooled gases would carry off more heat from the tubular than from the others.

Referring to authorities on this subject, it must be remembered that the progress of improvements in steam engineering is very rapid, so far as capacities of boilers and engines, through higher pressures and compound engines, are concerned, and authors on this subject are apt to be behind the times in their publications. My investigations on capacities of boilers and engines and the economy of power led me while in England into a factory near Manchester, which had 48,096 spindles, with all preparation for producing cotton cloths. This factory was run with two Lancashire boilers, 7 ft. diameter, 30 ft. long, with two 34″ flues, 856 ft. heating surface in each, which developed, through a quadruple or four-cylinder engine, 270 horse-power each, under 110 lbs. pressure—540 horse-power for the pair—with an economy of 1.77 lbs. of Yorkshire and Welsh coals per horse-power per hour, under a 16-hour test, by disinterested experts. The boilers had in connection with them a Green Economizer, set in the flue between the boiler and chimney, which raised the temperature of the feed water (which was taken from the condenser at 114°) up to 262°. I mention this to show how easy it would be to get 125 to 150 horse-power from one of these boilers through a high-pressure engine which did not require more than 30 lbs. of water per horse-power per hour, which would be for 150 horse-power, 4,500 lbs. of water per hour, and how economical such a boiler would be under 100 horse-power, at 30 lbs. evaporation per horse-power per hour.

OBSERVER.

Making Balance Wheels.

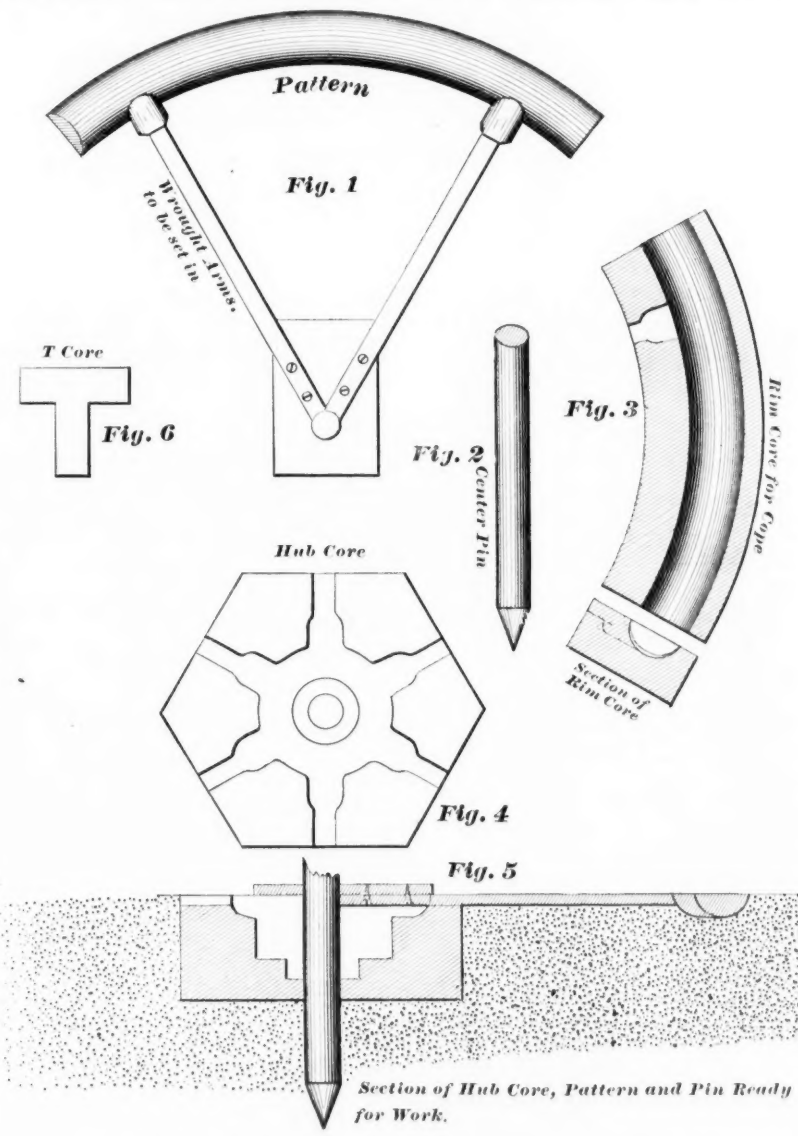
Editor American Machinist:

We have been making some large balance wheels, some whole and some split, so as to be put on without removing shaft. They were made with some little improvement on the old plan, and were so true and required such a small amount of work to finish them in the machine shop, I thought a description would be of interest.

For balance wheels up to five feet in diameter we use complete patterns, and follow boards, as the patterns are not likely to spring out of shape, and it is the quickest and cheapest method when there are a number to be made. For more than five feet in diameter we use a section of pattern with half-round rim, having half-round arms attached, as represented in Fig. 1. At the end and on the top side of this a plain board is fastened, having a hole in the center to admit the pin shown in Fig. 2. The top of rim and both top and bottom of hubs, are made of dry sand cores, the rim (Fig. 3) being made in sections, having a print in core-box to form fillet around wrought-iron arms; also to fit down over arms. In making the bottom part of hub core there is a print on top of center core-print long enough to leave a hole through the core of proper size to admit the center pin. Fig. 4 represents the bottom of hub core.

In moulding the wheel, after the bed has been struck up and the bottom hub core set true and level, drive in center pin through hole in core, taking care to have it plumb, then put pattern on, making sure that the hole in board at end of arms fits the center pin snugly. After bedding in one section, draw the pattern and swing it around until the arms fit in the recesses in the hub core, then bed in again, using a straight-edge across the face of mould to see that the pattern is up flush. Continue in like manner until the circle is formed, then place the wrought-iron arms and put on rim segments and top of hub, having pouring and churning gates through them, and fill up the center and outside and weight down.

Fig. 5 represents hub core, pattern and pin, set ready for work. We cast the rim one day and the hub the next. At one time we cast the hubs solid, and had to flow considerable iron through to get them sound, owing to the steam following up the wrought-iron arms into the hub and causing them to become damp. We left a space bare down to the arms between rim and hub for the steam to escape. Lately we have been setting in center core, and have no trouble to get a good, sound hub. To make a split wheel, we make the center core to split the hub in the usual way, and use a piece of sheet iron, clay washed, at the end of rim core segments to split the rim, nailing a T-core in bottom



Section of Hub Core, Pattern and Pin Ready for Work.

mould on each side of plate, straight end of T to plate, to form a recess to key the rim together.

ROBERT E. MASTERS.

Columbus Iron Works, Columbus, Ga.

A Word of Warning to Engineers.

Editor American Machinist:

Often a man is taught by accident what he might have learned otherwise, if it were not for the ungovernable fear of ridicule, or for pride, which we all have to a greater or less degree. For the former the old engineers are in a great measure to blame, as it is a fact that old hands, when asked by young men the cause or *why* of a thing, often give an evasive answer.

Where is the young man who will not resent it, when he asks a man a question and is told that after he has worked at the business long enough he will know himself?

But, my young friend, do not be discouraged. There are a great many good-hearted, honorable men, who will gladly tell you all, in fact, more than you ask. On the other hand, don't believe all you hear; listen to it, turn it over in your own mind, and if it looks practicable adopt it; if not, throw it one side. It is a great business, and no one man can know it all.

For instance: Going into a saw-mill the other day, and hearing the familiar puff, puff, puff of the engine, I could not resist the impulse to step into the boiler-room. The boiler was an internally-fired horizontal, 12 feet long and about 3 feet in diameter. Two of the curvilineal seams were leaking streams about the size of a needle. I said to the young man in charge, "Are you not afraid those leaks will do mischief?" His answer was, "Oh, no; I called the attention of the boss to it, and he said they were all right; besides, I am going to pack them the first time we stop."

"Pack them? What with?" "Why, don't you know that they always put red lead in between the joints when they build a boiler?"

"No; I do not know it. Who told you so?"

"Why, Mr. C., engineer at A."

Now, Mr. C. was a man who had a good job, and ought to have known better.

Now a word about books and papers. Read them, stop and consider as you read. Work out the problems, and compare them with your own plant. Compare one man's work with another's, and you will be astonished at the difference. But whatever you do, don't believe it all, or throw a work away because you find one or two examples in it that don't look practical to you.

I do not propose to say whether a work is correct or not, but merely to show up the facts. I got hold of a work the other day that gave the size of the steam pipe for a 144 horse-power engine to be 2.95 inches in diameter. It did not state that it would not be large enough if there were 300 feet of pipe and four or five elbows, nor that it would. It simply gave 2.95 inches as the diameter.

Now I have before me one of Stephen Roper's Engineers' Handy Books—a work as a whole I prize above all others. Nevertheless, on pages 448 and 449 there are rules given for finding the bursting and safe pressures for boilers, that differ so widely from some others that it would appear that one or the other of them must be wrong.

Taking the first rule, on page 448, gives the working pressure of a 48″ boiler, with iron $\frac{3}{8}$″ thick, at 87.5 pounds per square inch, while the rule given in the AMERICAN MACHINIST of April 16, 1881, gives for the same boiler 119.70 +, a variation of 32.20 pounds. Take the last example, on page 449, (I copy from the book) $\frac{1166.66 \times 12 \times 4}{2} = 31999.84$, when it should be 27999.84. This is undoubtedly an error in the printing. It is such things as these that confuse and hinder one, and when you come to them consider well before you commit them to memory.

So, young man, I would say read carefully all books of the kind. You will find something practical in every one.

And to my older brethren: Answer all questions put you by the young man, conscientiously and practically if you can. If not, tell him where he would be most likely to obtain the desired information, for you cannot tell what accident you are preventing by so doing.

PACKING.

Screw Cutting and Screw Cutting Attachments.

Editor American Machinist:

I have just read the communication of Professor John E. Sweet on threaded sleeves and open nuts for screw-cutting lathes. The principle is similar to the Fox and the Taylor lathes, in use in brass works, but the adaptation is different. In my estimation he has struck the key-note of a grand improvement in lathes for screw cutting.

I have puzzled my brains a great deal over the subject of a simpler device for feeding and screw-cutting attachments for lathes. One way that suggested itself was, to have two screws inside the bed, to be operated with two open nuts attached to the tool carriage, worked by a lever attached to the carriage, the lever operating both nuts. By locking the feed nut the piece could be turned to size, then unlock the feed nut and run the carriage back by hand and lock the screw nut to cut the thread, by that means having a simple and quick way for turning and screw threading any piece.

Why would it not be more advantageous for lathe manufacturers to furnish threaded sleeves and open nuts to match with their lathes for screw cutting in place of a stack of gears. Then any one ordering lathes would only order sleeves and nuts for the screws they wished to make. Now a large number of the gears furnished with the lathes are never used, whereas with the sleeves and nuts they could be kept in stock at hardware stores and tool depots, the same as taps and drills.

E. E. J.

Buffalo, N. Y.

Fire-Proof Tool Rooms.

Editor American Machinist:

I would like to inquire through the medium of the AMERICAN MACHINIST if any of your readers have had any experience with fire-proof tool rooms—if there are any in existence? The idea is suggested by the fact that the tool room is the repository of the most valuable part of a manufacturing plant—condensed into a small space—and that it contains, or should contain, tools, gauges, and fixtures that money could not duplicate, without time, patience, and skill, which, in case of fire, no amount of insurance can provide for.

It seems to me that as tool rooms are usually on the side, or in the corner of the shop, that the space they occupy could be made thoroughly fire-proof at a small expense, and in many cases, where rates are high, save enough on insurance to make the biggest kind of a dividend on the investment.

I think the discussion of this subject, and the manner of carrying out the details would result in mutual benefit to many shop owners, and perhaps to those who are in the "fire-proofing" business.

C. E. LIPE.

Syracuse, N. Y.

Calculating Iron for Casting.

Editor American Machinist:

In making calculations in the foundry for iron required for castings, I find the plan of dividing the cubic inches the casting will measure by 4, instead of multiplying by the decimal .26, much simpler, and near enough for all practical purposes. The division can be done mentally, and frequently the multiplication cannot—a matter of some importance in a foundry.

IRON.

A correspondent would like to hear from some reader of the AMERICAN MACHINIST as to what paste he had found best for fastening drawings or tracings to card-board. He has trouble with the drawings wrinkling. Also the best plan to pursue in mounting.

Momentum and Rules for Weighting Down Copes.

BY THOS. D. WEST.

SECOND PAPER.

There are various formulas for mathematically calculating the theoretical weight required to hold down copes. Mr. Tullis, in the AMERICAN MACHINIST of August 19, 1882, gave the following concise rule: "Specific gravity of water 1000. Specific gravity of iron 7202. Weight your cope; measure surface and height in feet, multiply by 7202. The answer will be in ounces."

Mr. Jewett, in the AMERICAN MACHINIST of September 9, 1882, gives a rule in a manner that should be very explicit to those who are ignorant of the subject, of which, I am sorry to say, there are thousands among moulders. He explains his rule as follows: "I assume a column of water 32 feet in height to equal 16 pounds water pressure, then 16 feet equals 8 pounds, and 8 feet equals 4 pounds. Iron is $7\frac{8}{10}$ times heavier than water, so, for 8 feet high, or four pounds of water, the corresponding pressure of iron would be four pounds, multiplied by $7\frac{8}{10}$ equals $31\frac{2}{10}$ lbs. Four feet head would be one half as much, or $15\frac{6}{10}$ pounds. Two feet—one half this latter quantity, or $7\frac{8}{10}$ pounds. One foot, one half this, or $3\frac{9}{10}$ pounds; and 6″ head would equal $1\frac{9}{10}$, or, say, 2 pounds. All displacement of cores must be computed according to depth, etc."

This rule of Mr. Jewett's, assuming, as it does, that iron is $7\frac{8}{10}$ heavier than water, leaves a margin upon the side of safety. According to this, a cubic foot of cast iron would weigh $487\frac{1}{2}$ pounds, while the actual weight of the common run of gray cast iron is about 450 pounds per cubic foot. However, the extra $37\frac{1}{2}$ pounds in every cubic foot, when used for flask weights, will only aid in making copes more secure. The outcome of his figures is, that to weight a cope there is $5\frac{1}{3}$ ounces of weight required for every inch in height of head and square inch of lifting surface. To show the practical application of the rule, the following example is given: The section of mould, as seen at Fig. 2, in first paper, is representative of a plate $12\frac{1}{32}$″x$12\frac{1}{32}$″, with area of pouring-gate and riser out; this would give us a lifting of 144″. Now, were we going to pour this with a head that would be 6″ from the joint up to the top of gate, we must multiply the $5\frac{1}{3}$ ounces six times, then with the product, which is 32 ounces, multiply the area of the cope's lifting surface, which is 144″. The product of this is 4608 ounces—288 lbs. Now, did we desire to pour such a mould with a head 12 inches high, we would simply have to double the weight of 288 lbs., making it 576 lbs. Were a plate 12″x12″, having a head of 12″ poured slowly at the last so as to bring the head up very easily, a weight of 460 pounds, including the cope, would be sufficient to hold it down. To do this, the gate and riser (the riser to be as large, or larger, in diameter than pouring gate), must be placed on the pattern, for were they to be placed upon the joint, and from them to the mould branch gates be cut, then there would be more than 144″ of lifting surface. 450 pounds being the weight of a cubic foot of cast iron, it is too near equilibrium to risk the 10 pounds added to the 450 holding down more area than the 144″. When the 460 pounds will hold down the 144″ lifting surface, it is easy to see that the 576 pounds, obtained for same purpose by Mr. Jewett's rule, will give a large margin of safety. With the cope's weight added to such a margin, we have sufficient weight, as proved by this experiment, to safely hold down the general run of copes. In moulds that will create extra momentum it would, in some cases, be best to add more weight than the rule and weight of cope gives.

A rule the writer uses for flask weights is as follows: *Multiply the lifting area by the height of gate, the product by the weight of a cubic inch of iron.* To obtain the weights, for instance to hold down the copes of the plate mould, 12″x12″ referred to above, the following example is for a twelve-inch head:

	12″
	12″
Lifting area	144″
Height of gate	12″
Cubic contents	1728
Weight of a cubic inch of iron	.26
Statical pressure	$449\frac{28}{100}$ lbs.

Fig. 7 is a section of pipe or column which we will suppose to be 12″ outside diameter, the thickness of metal 1″, length of casting 8′. As this example is one that will give ideas in calculating a great variety of moulds, it may be well to explain the nature of its lifting force. In such a mould we have two heads that exert a lifting pressure; one is that of the core, the other that of the cope. From bottom of lower half of core *B*, up to top of gate, is the cores height of head-

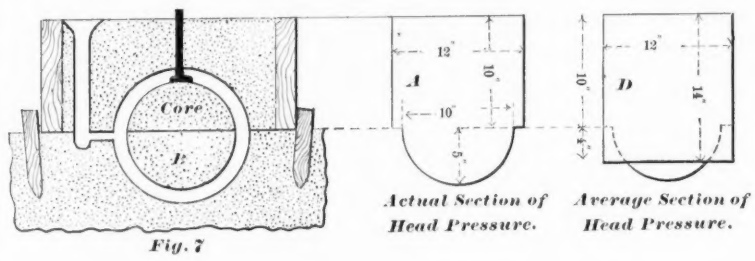
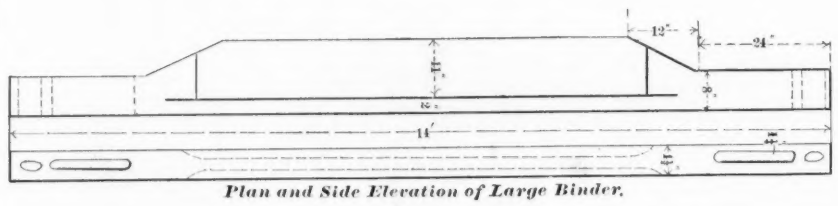
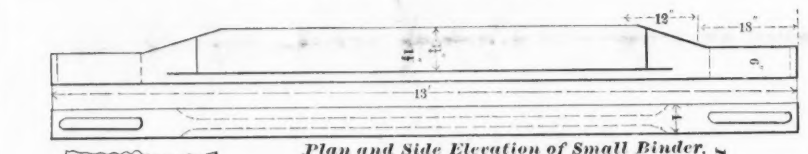


Fig. 7





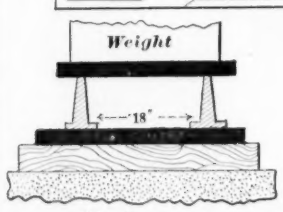


Fig. 8

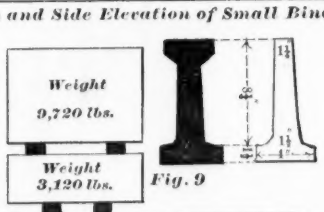
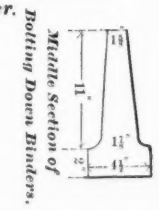
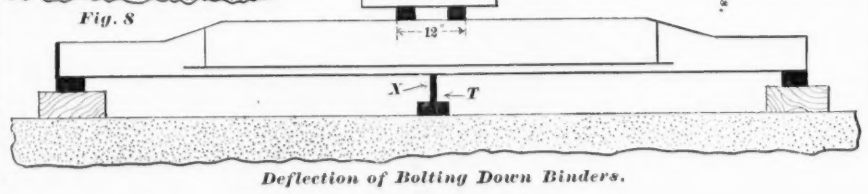


Fig. 9





Deflection of Bolting Down Binders.

pressure. From the joint up to top of gate is the lifting pressure of cope. The weight required to be placed on the cope to hold it down would be what such a section as *A* would weigh in a length of 8′ long. To figure the pressure we first obtain the sectional area of the half circle, which is $39\frac{1}{4}$″, then the sectional area of the upper oblong portion, which is 120″, the two combined giving a sectional area of $159\frac{1}{4}$″ This, multiplied by the length, 96″, gives us 15288″, which, multiplied by the weight of a cubic inch of iron, gives us, $3974\frac{88}{100}$ pounds, the weight to be placed upon the cope. In practice, were I to figure the pressure upon such a cope, I would not bother finding the sectional area of the lifting heads, but would simply average the half circle by taking in even numbers fully two-thirds its vertical height and add it it to the vertical height of head above the joint. This would throw the sectional halfcircle area into a plain horizontal measurement, thereby giving a horizontal surface to be multiplied by the average inches added to the gate's height, as shown at *D*. The curved dotted lines seen shows where the horizontal plane was drawn in averaging the half circle. To figure the pressure in this way, the example would be as follows:

Length of lifting surface	92″
Width " "	12″
Area	1104″
Height of head pressure	14″
Cubic contents	15456″
Weight of a cubic inch of iron	.26
Statical pressure	$4018\frac{56}{100}$ lbs.

Figuring the pressure according to the exact size of the lifting area, as seen above, we obtain $3974\frac{88}{100}$ pounds as the statical pressure. In guessing at the average, as in the last example, the statical pressure obtained, as seen, is $4018\frac{56}{100}$ pounds. This gives a weight of $43\frac{66}{100}$ pounds more than the exact area calls for.

The rule I have here given is one that can to an extent be worked mentally, and therefore will be of much assistance in aiding to determine (where time will not admit of figuring) the weight necessary to hold down a cope. To find the weight mentally: *Form in the mind, by mental calculation, a weight equal to the size of the horizontal lifting surface up to the top of gate.*

While this will no doubt appear very crude, it will, with practice, enable one to become very proficient in the art of guessing, especially if he will occasionally figure to learn how near he guessed. Of course, in guessing there should be a large margin upon the side of safety as it is not possible that all can guess as closely as they can figure. The term statical means acting by mere weight, and is applied to the pressure on copes, after the momemtum impulse has ceased. To overcome the momentum, good judgment must be exercised in determining its lifting force, and to weight sufficient to hold it down added. If the mode of gating and pouring does not create much momentum, then the statical weight combined with the cope's weight will be sufficient to hold it down.

The decimal .26 here used as the weight of a cubic inch of cast iron is not as near as we could figure, but as its use involves the least figures, and it is not far from the exact weight of a cubic inch of cast iron, it is adopted.

While upon this subject of cope pressure it seems a fitting place to present a few notes upon bolting-down binders, as will be seen working plans are shown of top binders. The two sizes shown I sketched from those in actual use in our foundry. The design is one which I think is very handy for practical use. Wishing to know how much the bars would spring with a given weight, I had them supported at the ends and loaded in the middle, as shown in the engravings. The end view at Fig. 8, shows the plan adopted in order to load with the shop's weights. Two binders were rested upon solid end bearings, the distance between the binders being 18″. As seen in side view, two flat bars were set 12″ apart, after which the weights, which weighed upon the scales 12840 pounds, were hoisted on. After being loaded a template was fitted between the bottoms of binders and iron block *T*, as seen at *X*. The weights were now hoisted off. With the top weights of 9720 pounds off, the binders raised up $\frac{6}{32}$″, when the total weight of 12840 pounds were off, the space between the template and binders showed this weight had deflected them $\frac{9}{32}$″. The large binders were next tested, the same weights being used. With the 9720 pounds off they raised up $\frac{7}{64}$″; with the total 12840 pounds off, the space showed the two binders had deflected $\frac{1}{8}$″. These experiments are interesting, as it may by them be seen that it is wrong to suppose that a cope cannot raise because it is "bolted down." When well bolted down, I am fully aware it will not raise so as to allow iron to run out, but this is not the raise I refer to. The raise that is likely to occur is where, for instance, there is a heavy lift at about the middle of the binders, such as would be caused by the binders holding down deep cores. It is, as a general thing, when cores have their vents taken off through the bottom of the mould that we are likely to have trouble through the binders, liability to spring when the head pressure comes upon them.

Taking core vents off through the bottom of mould is in some cases very risky, for should they raise $\frac{1}{32}$″ it is sufficient to let the metal strain itself into the vents, and thereby send the casting to the "scrap-heap." Many moulders, to their sorrow, know this to be a fact. All binders will spring more or less. When there is danger of iron getting into under vents, we should weight down the center portion of the binders to the best of our judgment, so as to resist the tendency of any spring. While the design of binders here shown is very good, I think were a bottom flange cast on them, as seen in Fig. 9, the stiffness, by the addition of a few pounds of iron, would be greatly increased.

As nearly all copes at the present day are weighted by guess work, and some by no thought whatever, the rules and fundamental principle herein set forth, may be of use. While the rules will be of value in aiding to determine cope weights, it must be remembered that there are a hundred-and-one things that no rule can cover. Good judgment backed by experience must be our guide in successfully providing for copes standing that often dreaded test,—"head pressure."

If the ideas of an English inventor are fully realized, the question of electric lighting, or rather its economy over all other forms of artificial light, will be definitely settled. He proposes to furnish the electricity by the use of chemical means, and he claims that what is left will be much more valuable after than before being used. The *Pall Mall Gazette* suggests that it will be in order to light up the whole United Kingdom and pay the National debt with the profits.

One line of street railway in Brussels is to be equipped with electric motors which are to be used for one year, an accurate account of expenses being kept to determine the relative economy as compared with horses. Should the experiment be successful, all the lines in Brussels will be similarly equipped.

This is the only plan likely to prove of any definite value in settling the economy and advisability of electric propulsion for this purpose. Making a plaything of the whole matter, as is being done in this country, will never serve any useful purpose. It is possible to do a great many things that it is not advisable to do, for various reasons.

Compound Engines of the Steam Yacht Lady Torfrida.

We are indebted to our esteemed London contemporary, *Engineering*, for the engraving and description of the engines of the steam yacht Lady Torfrida, with some particulars of the vessel itself, appearing upon this page.

"The Lady Torfrida," says our contemporary, "is the most perfect vessel of her kind that has yet been built on the Clyde, while as a privately-owned yacht there is probably no equal to her in British waters. Her construction, equipment, and fitting out were specially supervised by the owner. Built of steel, and measuring 200 ft. 8 in. long, 25 ft. 7 in. in breadth of beam, and 15 ft. 7 in. in depth, she has a tonnage of $610\frac{4}{94}$."

The engines of the Lady Torfrida are nominally of 175 horse-power; on trial they indicated 1020 horse-power, with a steam pressure of 110 lbs. per square inch, and a vacuum of 28½ in. Their general design is shown by the perspective view given on this page. They are compound surface-condensing, and have three inverted cylinders, viz., one high pressure having a diameter of 24 in., and two low pressure, each of 34 in. in diameter, the length of stroke being 2 ft. 6 in. All the cylinders are steam-jacketed. The high-pressure cylinder, which is placed between the other two, has a valve of the equilibrium-piston type, while the low-pressure cylinders are fitted with ordinary slide valves. These valves are placed between the cylinders, and are worked by the usual eccentrics and link motion. The reversing of the engines is effected by means of a steam and hydraulic reversing engine, made by Messrs. Brown Brothers, of Edinburgh.

The crank-shaft is of crucible cast steel, made by Messrs. Vickers, Sons and Co. (Limited), and has three cranks; it is one solid forging, and has main bearings 10 in. in diameter and 10 in. long, while the crank-pin bearings are 9½ in. in diameter, and 10½ in. long. The tunnel and propeller shafts are also made of Messrs. Vickers' steel.

As will be seen from the engraving, the surface condenser is placed at the back of the engines, the water being supplied to it by a reciprocating circulating pump worked by levers connected to the crosshead of one of the low-pressure engines—the air, feed, and bilge pumps being worked in a similar manner by the other low-pressure engine. The surface condenser exposes 1978 square ft. of surface, and the air pump, which is single-acting, is 20 in. in diameter with 17 in. stroke, its discharging capacity being thus $\frac{1}{30.4}$ of the combined capacities of the two low-pressure cylinders.

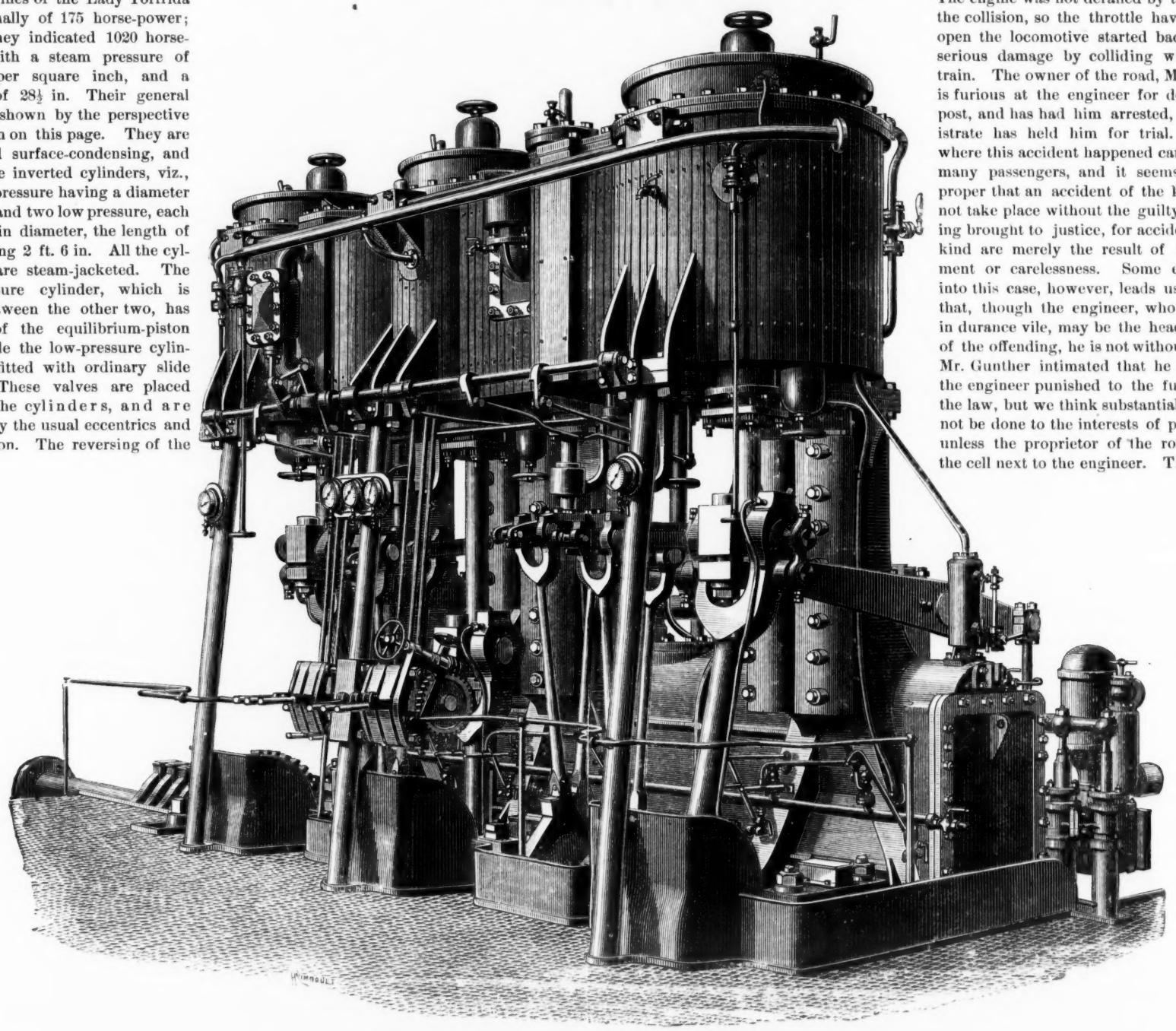
As is now almost the universal rule with Messrs. Elder & Co., the propeller is formed of solid manganese bronze, and it is 11 ft. in diameter with 14 ft. 6 in. pitch. The boiler for supplying steam to the engines is single-ended and multitubular, and is made entirely of mild steel. It is 14 ft. 6 in. in diameter by 9 ft. long, and is fitted with three of Fox's patent corrugated furnaces, and brass tubes. The heating surface is 1887 square feet, and the grate surface 77 square feet.

The accommodation of the yacht is spacious and well-planned, while the decorations are most elaborate. The deck saloon is floored with various kinds of woods in parquetry, and the seats are cushioned in red morocco, a table being placed at the further end. The main saloon is both lofty and well proportioned. Its fittings and carvings, which have been designed in the style of the Italian Renaissance, are of dark mahogany, artistically grouped, and separated by gilt pilasters of a highly ornate character. The wall panels are covered with silk brocatelle in shades of terra-cotta and olive. Oil paintings on gold leather grounds representing ancient galleys conventionally treated, are inserted in the center compartments, two on each side of the saloon. A pleasing effect is obtained by enclosing the side lights with elliptically-formed bays filled with lead-stained glass, which can be illuminated at night by a lamp placed inside, while two lamps of elegant design are suspended from the ceiling, which is paneled with mouldings run into octagonal and square forms and appropriately decorated. The saloon is very handsomely furnished, panels of hand-painted tapestry in Louis XVI. style, fitted into the backs of the piano and writing-table, forming one of the decorative features. The *portieres*, which were specially made in Paris, are of gray-blue satin, richly embroidered after the manner of old Persian work.

Aft from the main saloon there are situated the ladies' cabin and the owner's room, the fittings and decorations of which are quite in keeping with those of the main saloon. From the latter there is a corridor, on either side of which are disposed the guests' state rooms, of which there are six forward and two aft. These state rooms are thoroughly ventilated, and furnished with a careful regard to comfort and convenience. The smoking room, already mentioned, is situated at the aft end of the deck house. It is also floored in parquetry, and is comfortably seated. The accommodation for the officers and crew is provided aft. For the former it includes a general mess room and a state room for each.

The Lady Torfrida is fitted throughout with every modern appliance for working convenience. The skylights, throughout, are of stained glass of rich coloring, all having appropriate designs.

On trial, the Lady Torfrida attained a maximum speed of 15 knots per hour, but she is usually run at a speed of about 13½ knots.



COMPOUND ENGINES OF THE STEAM YACHT LADY TORFRIDA.

Josh Billings says: "To soothe an engineer's brain and calm his bile, the calculus is like castor ile."

In England the South Staffordshire nailers have agreed to accept a 10 per cent. reduction of wages, thus averting a strike. The reduction applies to spike and large nails.

Railroad earnings for the month of June this year, generally show up smaller than for the same month last year. The most notable exception is the Northern Pacific, which records a remarkable gain. Railroads are not so much inclined to report earnings as they were a year ago. Rates are lower in many instances, and there is less freight to carry.

A somewhat serious accident happened the other day on the Brooklyn, Bath & Coney Island Railroad. This railroad is a half-breed between a tramway and a railroad; is owned by one individual, C. G. Gunther, and is operated in the crudest kind of way. Principally through the faults of operating two trains came together on the same track, and the engineer of one of the engines, after reversing, jumped off before the collision occurred. A common occurrence followed. The engine was not derailed by the shock of the collision, so the throttle having sprung open the locomotive started back, and did serious damage by colliding with another train. The owner of the road, Mr. Gunther, is furious at the engineer for deserting his post, and has had him arrested, and a magistrate has held him for trial. The road where this accident happened carries a great many passengers, and it seems right and proper that an accident of the kind should not take place without the guilty parties being brought to justice, for accidents of that kind are merely the result of mismanagement or carelessness. Some examination into this case, however, leads us to believe that, though the engineer, who languishes in durance vile, may be the head and front of the offending, he is not without company. Mr. Gunther intimated that he would have the engineer punished to the full extent of the law, but we think substantial justice will not be done to the interests of public safety unless the proprietor of the road occupies the cell next to the engineer. The accident happened through an inexcusable attempt to run a work train through a single line among passenger trains at a time when the road should have been left clear for the trains that belonged to it. Then there was a defective way of giving orders, and the safety appliances were defective. In most cases where accidents occur through these causes, there is difficulty in locating the blame, as presidents and directors often prevent railroad managers from providing proper means of safety. Here we have an exclusive railroad proprietor, who has no one to share his blame. He ought certainly to be used as an example.

If any of our readers have had experience with some unpatented process of nickel-plating in a small way, we should be glad to hear of it for the benefit of several inquirers. Numerous processes have been made public which generally prove failures. We want something from experience.

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NEW YORK, AUGUST 2, 1884.

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Nobody to Blame.

Two machinists and two helpers lost their lives last week by being asphyxiated in a sewer connected with the Calumet Iron and Steel Works, Cummings, Ill. A gas pipe passed through the sewer where the deaths occurred, and the men were sent in by the engineer to caulk a joint that was leaking. The pit was full of carbonic acid gas, and the four men succumbed and were taken out dead. An investigation followed, and the verdict was that the deaths were purely accidental, nobody being to blame.

Recently, the morning papers announced the death of three men who were crushed into shapeless masses of humanity by an iron bucket used in excavations at Brooklyn. The wire rope which supported the bucket snapped, letting the heavy vessel fall upon the workmen below, with the result noted. The comments made told that it was purely an unforeseen accident, and that nobody was to blame.

A week seldom passes without readers of the daily papers meeting with records of accidents to those engaged in industrial operations, where it seems some one ought clearly to be responsible, yet the verdict generally reads, "No one to blame." Were the numerous misfortunes that result in injury to life and limb investigated by competent persons, it would be found that by far the greater part of them were brought about by gross carelessness, criminal ignorance or recklessness. A manufacturer, or employer of labor, who knowingly puts men into danger through employing ignorant or incompetent foremen, ought to be held as strictly responsible for resulting damage as is the man who knowingly employs a dangerous machine without taking precautions to prevent accident. The fact is, human life is held too cheap among us, and there are too few precautions taken to prevent workmen from receiving injury. In this respect we are away behind all other leading industrial nations, which seems to be a curious anomaly, since the workmen abroad have little direct influence on law-making. There was a spirit of stern justice about the ancient law which held a man responsible for goring done by his ox. We need a little more of that spirit introduced into the laws that regulate modern justice, and juries need to be inspired with the sentiment that it is right to hold the owner of any form of man-gorer to rigid account.

The interest taken by British newspapers in the progress and results of the American political struggle this year is remarkable. They take particular interest in the choice of a President and members of Congress. On the other hand, there is no anxiety in this country about which party controls the British Government.

Depression of British Industries.

The industrial situation in Britain, according to their principal industrial newspapers, is one of great depression. In the iron and metal trades, reductions of wages, stoppages of works, strikes and failures are the subjects of notes from week to week. In a recent issue of *Martineau & Smith's Hardware Trade Journal*, of Birmingham, we find the following:

"In Cleveland and the West of Scotland the depression in the pig iron trade is more marked than ever; and no good results have yet followed the partial combination to restrict the output of iron. In South Staffordshire—once the chief seat of the iron trade—the works in actual operation are kept on less than half time, while it is found necessary to close others altogether. In fact, the prospects are so discouraging that works and blast furnaces, once highly profitable, are being demolished at a truly alarming rate."

This is certainly bad enough, but the following paragraph from the same paper shows all business to be in a state of torpor:

"Perhaps the best index to the condition of enterprise of all kinds throughout the country is to be found in the state of complete stagnation into which the money market has drifted. For a time the crisis in New York imparted some firmness to the rate during the early part of May; but since then the rates have come under normal influences, and a steady decline has been in progress."

We should like to hear from the free trade philosophers as to the cause of this depression in England. What sound rule of political economy has been violated by the British Government to bring on such depression? It certainly cannot be attributed to any natural cause, such as failure of crops or a pestilence. It has not yet brought prices down low enough in steel rails, for instance, that British makers can undersell those of other countries. A recent order for rails for the British Government was placed with Belgian manufacturers because they could supply them cheaper. In many other lines of production English manufacturers are being beaten by the cheaper labor obtained by manufacturers in other European countries. In some cases English manufacturers have moved their works to foreign countries to get cheaper labor. With free trade and cheap land and water transportation the process of leveling wages must go on. The British workman cannot expect to continue to receive so much more than his Continental cousins for the same production. Unless Britain adopts the protective policy her prestige as a manufacturing nation will, sooner or later, be lost forever.

Success of a Young Mechanic.

The promotion of Mr. A. J. Pitkin, formerly mechanical engineer of the Schenectady Locomotive Works, to the position of superintendent is a recognition of high worth, and is a merited compliment to an engineer who is very young to fill such an important position. The success of Mr. Pitkin ought to stimulate ambitious young mechanics into habits of industry, for to his own unaided exertions is this machinist indebted for his gratifying success in life. He was brought up on a farm in Ohio, and on many a hot summer day, as he toiled among the corn, he cherished the ambition of yet rising to the altitude of running a locomotive similar to the engines that pulled trains through his father's farm. The first move towards realizing this ambition was his entering as an apprentice in a country machine shop, where he faithfully served his time learning to do machine work under all the disadvantages common in such shops. From this he went to the Baldwin Locomotive Works at Philadelphia, as a machinist. During his leisure hours he had learned drawing, and his success in this art was so marked that after a time he obtained a place in the drawing office of the Baldwin Works. A year or two ago Mr. Pitkin joined the Schenectady Locomotive Works, and his mechanical and executive ability have impressed themselves on those works. The excellent system now followed in the Schenectady Locomotive Works has been in a great measure planned and perfected by Mr. Pitkin, and the trustees have been wise in their generation in appointing him to take full charge.

The mean pressure of steam cut off at $\frac{1}{4}$ stroke, 95 pounds absolute pressure, is 56 lbs; at $\frac{1}{2}$ stroke 80, and at $\frac{3}{4}$ stroke 91 lbs., in round numbers. Even if it could be demonstrated that, all things considered, the best economy in a single cylinder engine, so far as cost of running and maintenance is concerned, resulted from cutting-off at, say, $\frac{1}{2}$ stroke, so late cut-off would not be at all satisfactory for most purposes for which a steam engine is used. It would be quite the reverse of economical for nine-tenths of the stationary engines in use, because the margin of reserve power would be entirely too small for good regulation. The mean pressure increases by 43 per cent. from $\frac{1}{4}$ to $\frac{1}{2}$ cut off, and from $\frac{1}{2}$ to $\frac{3}{4}$ by less than 14 per cent.—an amount that might be lost any day by an accidental fall in boiler pressure, and which in any event is not sufficient to pick up without a lengthy drag in speed a small percentage of work that in almost every manufacturing business is likely to be thrown on and off perhaps fifty times a day. There are a good many valid reasons why builders of stationary engines calculate their engines to do their work at about $\frac{1}{4}$ cut-off; reasons that are not likely to be disturbed by any amount of words or figures, because they are based on experience. Fortunately it is not necessary to consider much besides the economical use of steam, other economical considerations being, in the great majority of instances, comprehended in this.

Query: How much independence is there among the leading metropolitan daily papers that are habitually supplied with free passes over the railroads, and that dare not condemn the careless management of a road when an accident happens?

Literary Notes.

Recent Processes in Dynamo-Electric Machines. Being a supplement to "Dynamo-Electric Machinery." By Sylvanus P. Thompson, B.A., D.Sc., M. S. T. E. New York: D. Van Nostrand, Publisher, 23 Murray and 27 Warren Sts. Price, 50 cents.

To the increasing number of those who are interested in electricity, this continuation of Prof. Thompson's lectures will be welcome. The book contains several engravings of modern dynamos, and illustrative of the text. The author is well known as good authority in such matters, and presents the subject with clearness and strength.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(288) J. R., Brooklyn, N. Y., asks: Does a young machinist, who enlists in the navy as fireman, stand a chance of being promoted to engineer? *A.*—We think his chances would be very small, indeed.

(289) W. S., Passaic, N. J., asks: What is meant by the degree of a curve as applied to railroads? *A.*—"The degree of a curve is determined by the angle subtended at its center by a chord of 100 feet."

(290) W. A., St. Louis, Mo., asks: Is there any work published, that you can recommend, on the care and management of electric lighting machinery? *A.*—There is no such book in print, that we are aware of.

(291) E. C. H., Woodstown, ——, asks: How are the pistons of hand fire engines packed? *A.*—Sometimes the pistons are solid, with no packing, sometimes they are packed with leather, and sometimes with hemp.

(292) J. G. H., Lawrence, Mass., will find instruction in case-hardening in the AMERICAN MACHINIST, of November 8, 1879; December 18, 1880; January 1, 22, and 29, 1881; February 5 and 12, 1881; April 22, 1882, and December 23, 1882.

(293) Machinist, Providence, R. I., writes: In your issue of July 5, in an article on putting in a new crank pin, mention is made of a level, the bulb of which would move $\frac{1}{16}$" when the surface upon which the level rests is deflected 1-1000 of an inch in 10 inches. I should like to know where I can get such a level? *A.*—You may find it impossible to buy a level as fine as this, but you can get one made, or at least the glass for one, by a maker of mathematical instruments

(294) A. F. W., Providence, R. I., asks: 1. Please give a rule for proportioning cone pulleys to produce any given ratio of speed? *A.*—See AMERICAN MACHINIST of February 5, October 15 and 22, and November 26, 1881, also February 25, 1882. 2. How shall I prepare color for tinting a tracing on cloth? Ordinary water color wrinkles the cloth. *A.*—We know of no other way (than using water colors) except to tint with colored crayons or pencils. 3. What material can I use for polishing glass? *A.*—Pumice powder first and then crocus.

(295) J. W. M., Noblesville, Ind., writes: I have a portable engine 6"x12", with 40" pulley. I put a brake on pulley attached to spring balance, and with 120 lbs. steam, 250 revolutions per minute, the balance stood at 280 lbs. What horse-power does that represent, and how do you calculate it? *A.*—You neglect to state at what distance from the center of the shaft the friction was weighed. To make the calculation, consider the 280 lbs. as acting to revolve the shaft at whatever the distance may be from the center, and proceed as in finding the horse-power of an engine. Suppose you weighed the friction at the circumference of the pulley: the circumference of a 40" pulley is 10.47 feet, and the speed will be $10.47 \times 250 = 2617.5$ feet per minute, and then $2617.5 \times 280 = 732900$, which, divided by $33000 = 22+$horse-power.

(296) A. F., Paris, Texas, asks: Does a cross-belt run harder than an open one, the size of pulleys and distance apart being the same? *A.*—Generally speaking, there may be said to be a small loss in the use of the cross-belt, but not enough to consider where its use is advisable. Sometimes there is a gain from the fact that the cross-belt is in contact with more of the surface of the pulley, and need not be so tight. A crossed belt is not likely to last as long as an open one, and where the latter can be used it is generally advisable to do so.

(297) J. C., Boston, Mass., writes: I have an upright boiler 6 ft. high, diameter 30″; fire-box 24″x24″; forty-four tubes 2″ diameter and 4 feet long. Can I use this boiler to run, for a few months, a 7″x12′ well-built slide valve engine, cutting-off at ⅝ stroke, 60 lbs. boiler pressure, engine running at 80 revolutions, and how much power can I get? *A.*—You would probably get from 5 to 6-horse power from the engine, and the boiler should make steam enough to run it. You could get more power from the engine by running faster, and probably manage for steam by exhausting in the stack.

(298) C. H., Wilkesbarre, Pa., asks: 1. Is Dr. Zeuner's work on valve motion superior to any other, and are methods of drawing valve diagrams where the crank angles are neglected satisfactory for practical purposes? *A.*—Dr. Zeuner's work is generally considered very satisfactory. Crank angles should always be considered in plotting valve diagrams. 2. Is there in any numbers of the AMERICAN MACHINIST a clear description of the balanced valves mentioned in No. 28, 1884? *A.*—You will find description of two of these valves in the AMERICAN MACHINIST of July 16, 1881, and February 25, 1882.

(299) A. M., Milwaukee, Wis., asks: What is the highest speed ever attained by an American or English locomotive, and the average speed of British mail and express trains; also if it is true that trains run ninety miles an hour in the East? *A.*—We cannot give the highest speed made by locomotives, and we believe it is not known with any degree of accuracy. Probably ninety miles an hour has been made for short distances by American and British locomotives. The average speed of British mail and express trains is under forty miles an hour, although one express train has a card time over fifty-three miles an hour. Some of the express trains on the Philadelphia and Reading, the Pennsylvania, and the New York Central railroads reach a speed of about forty-five miles an hour, which is the fastest schedule time in this country. No train in the world is timed at sixty miles an hour.

(300) A. F. W., Providence, R. I., asks: 1. In setting a horizontal tubular boiler, what should be the distance of bridge wall from the shell, or what should be the proportion of opening over bridge wall, and should it follow the curve of the boiler? *A.*—Make the opening over bridge wall about 50 per cent. greater than the opening through tubes. Some prefer to make the top of bridge to correspond with the circle of shell; others make it straight across. It seems to make no difference with results which way it is made. 2. What should be the distance of grate from boiler for hard, and what for soft coal? *A.*—There is great difference in opinion on this subject, with a tendency to increase the distance. 24″ to 30″ for hard coal and 36″ for soft coal are distances frequently used. 3. How should the brick be laid back of bridge wall? *A.*—The principal use of brick from bridge wall to end of boiler is for convenience in cleaning. They are generally laid so as to leave a space of from 8″ to 12″ from boiler.

(301) E. H., Houlton, Me., asks: 1. After the steam exhausts from the high-pressure cylinder of a compound engine into the low-pressure cylinder, is there any back pressure on the high-pressure cylinder; and, if so, why? *A.*—Suppose the communication between the two cylinders to be open, a little consideration will show you that the back pressure, per square inch, in the high-pressure cylinder, must be at least equal to the forward pressure in the low-pressure cylinder. 2. I understand that forming a vacuum is simply removing the pressure of the atmosphere, which is 14.7 lbs. per square inch. How then is it that as high as 29 lbs. of vacuum is obtained? *A.*—It is not. You are confounding inches with pounds. A vacuum of 29 inches is equivalent to about 14 lbs. 3. In answer to Question 247, what is meant by the terminal pressure being above vacuum when the saws are on, and below when they are off? *A.*—The compression is substantially the same at all times (in the engine referred to); when the saws are off the work is light, and the steam is expanded lower than it is compressed; when the saws are on the work is increased and the steam is not expanded so low. 4. What is meant by expansion curves? *A.*—If you will read the articles on the Indicator Diagram, that have appeared in the AMERICAN MACHINIST this year, you will find this question answered. 5. What per cent. is gained by running an engine condensing, using a circulating pump? *A.*—The gain may be anywhere from nothing to 25 per cent., according to circumstances.

(302) F. R. K., Camden, N. J., asks: 1. What should be the proportions of valve, ports, etc., for a slide-valve engine 4″x5″, to run 400 revolutions, to cut-off at 1-5 and ¼ stroke; also at ¾ stroke? *A.*—It is not practicable to make a plain slide-valve engine cut-off as short as ¼ stroke. You can make steam ports ⅝″x4″; exhaust port ¾″x4″; bridges 7-16″; outside lap of valve ⅜″; inside lap 1-16″; travel 1⅛″. The cut-off will be at ¾ stroke. 2. What is the best lining metal for durability? *A.*—Metal made according to Babbitt's formula gives good results. 3. Will a fan give more blast with the same power if the blades nearly fill the case than if there is considerable space both at the sides and at the periphery? *A.*—It depends upon the construction of the fan. Where space is given at the sides of the blades it is generally because the manufacturer finds it an advantage. The outline of the case, against the ends of the blades, is generally an arithmetical spiral—close to the ends of the blades at one point, the distance increasing around to the outlet. 4. How much pressure per square inch will be required to throw a ⅝″ stream 75 feet through 16 feet of 1½″ hose? *A.*—There is no way of pre determining this with any exactness. As an estimate, say 50 lbs. 5. Would brass be a good material for a piston head, or would cast iron be better, in a cast-iron cylinder; also should the rings be brass or cast iron? *A.*—Our preference would be cast iron for both piston and rings. 6. Is it not better to have the steam passages or ports as short as possible? *A.*—Yes. 7. Should the clearance between piston and heads in a 4″x5″ engine be less than ¼″? *A.*—⅛″ will be sufficient.

BUSINESS SPECIALS

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Mackenzie Cupolas and Blowers. 245 Broadway, N.Y.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Interchangeable work a specialty. Send stamp for new Lathe Catalogue. E. O. Chase, Newark, N. J.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Fine tools and special machinery. Horace Thurston, 84 Clifford street, Providence, R. I.

Herbert W. T. Jenner, Mechanical Engineer and Solicitor of Patents, 632 F st., Washington, D. C.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Universal grinders for lathe-centers, chucks, angles, or cylinders. C. C. Hill, 84 Market st., Chicago, Ill.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

National and box chucks, foot and power lathes, and slide rests. Lodge, Barker & Co., Cincinnati, O.

DRAWINGS—Mechanical, electrical and Patent Office. All styles of artistic designing. Special facilities. Low rates. Wallace Metcalf, 140 Nassau St., N. Y.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Improved Tack Machinery, made by The Willets Man'f'g Co., can be seen in operation at their works, 57 Clifford St., Providence, R. I.

The "Wax Process" Engravings shown in the AMERICAN MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

Difficult machines invented and built; coarse screws cut. V rotary files for fine milling, by mail 50 cts. Tower Machine Works, E. Brookfield, Mass.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large: prices low. Frasse & Co., 62 Chatham St., N. Y.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50: Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

EXTRACTS FROM CHORDAL'S LETTERS, 400 pages, 12mo., handsomely bound in cloth. New and enlarged edition, with over 50 illustrations. Price $2. Published by John Wiley & Sons, 15 Astor place, New York.

For a strictly first-class automatic engine, from 10 to 60-horse power, apply to the Straight-Line Engine Company, Syracuse, N. Y.; medium or high-speed; perfect balance; fewest parts and fewest working joints; uniform speed at all ranges of power or steam pressure; the best material and workmanship in all vital parts; the most correct distribution of iron; unexcelled in smooth running.

MANUFACTURES

Z. T. Hollingsworth will erect new shops at 134 Eliot street, Boston.

The Shelton (Conn.) Brass Mill is to have an addition 100x75 feet and three stories high.

David Van Cleaf will erect a three-story brick shop at 7 Summit street, Brooklyn, N. Y.

Mr. Alvin Streeter, of Winchendon, Mass., is putting in a foundation for a new machine shop.

Seaman, Cox & Brown will erect a three-story addition to their factory, 147 Hoyne avenue, Chicago.

The Cumberland Steel Works Company, Cumberland, Md., will be organized with a capital of $150,000.

William Manchester & Son, of the Keystone Boiler Works, Pittsburgh, Pa., have just finished several new additions to their works.

A reduction of 10 per cent. in the wages of the employes of the Pennsylvania Steel Works, at Steelton, is announced, to take effect on August 1st.

Stokes & Parrish, machinery manufacturers of Philadelphia, have merged their business into the Stokes & Parrish Machine Company. Capital $150,000.

The Bullard Repeating Arms Company, Springfield, Mass., is about increasing the capacity of the works by additions to the working force and the machinery.

The half-dozen pistol factories in Norwich, Conn., have suspended work because of lack of orders. Owning and carrying a pistol is a luxury that can well be dispensed with in dull times.

The Plume & Atwood Company, Waterbury, Conn., are building an addition to their works, 165x53 feet, two stories high. It will be used as a brass tube mill, moulding shop, and rivet shop.

The furniture factory of Martin Worn, Siegel street, Brooklyn, N. Y., was recently struck by lightning and burned. It will be rebuilt as soon as possible. About three hundred hands were employed.

The J., M. and I. railway shops, which have been located in Jeffersonville since 1848, will be removed to Indianapolis within sixty days. The work of repairing for the Jeffersonville road will only be done there.

Natural gas has lately become an important fuel in Pittsburgh and vicinity. The Westinghouse Machine Company have contracted to have four new wells dug, and several of the rolling-mill companies are having wells put down for gas.

John Jarrett figures the cost of producing a ton of tin plates, between England and the United States at $22.56 in favor of England, which is slightly above the duty and does not take into consideration the extra cost of ore, tin, scrap, brick, etc.

It is said that enterprising citizens of Hubbard, O., are waiting for some manufacturing establishment that will locate there for a bonus of $10,000. If the conditions are not too exacting, we are of the opinion that they won't have to wait long.

The proprietors of the National Knitting Works, of Milwaukee, Wis., have purchased two acres of land in the Kinnickinnie Valley, west of the Whitehill sewing machine factory, for $5,000, and will erect thereon, at a cost of about $25,000, a large factory building for their own use.

A reduction of 25 per cent. has been made in the wages of all the workmen at the Bingen and Northampton furnaces, owned by the Bethlehem (Pa.) Iron Company. The keepers, who have been getting $1.85 per day, now receive $1.39, and stock-breakers, who got $1.25, now get 94 cents per day.

The Buffalo (N. Y.) Forge Company, are building an addition to their foundry, 75x185 feet in extent, which will double their capacity in this department. They intend shortly to also enlarge their factory, by the erection of a building 50x125 feet, two stories in height, to accommodate a new line of business.

The daily product of paper at Holyoke is closely estimated at the enormous amount of one hundred and seventy-seven tons. A large part of the product is fine writing and book papers. More than $5,000,000 are invested in the business, which gives employment to between four thousand and five thousand hands.

The Reading (Pa.) Tack Company have erected some new machinery for the tinning of tacks for carpet and other use. The works will shortly be increased to quadruple their present capacity, which is about one thousand pounds a day. About twenty-five hands are employed, and these will be increased to one hundred or more.

Heald & Morris, Baldwinsville, N. Y., have issued a new illustrated catalogue and price-list of steam engines and centrifugal pumps, as made by them. They claim to be the oldest manufacturers of centrifugal pumps, and that their sales exceed those of all others combined. They note that more than one thousand of their engines are in daily use throughout the country.

Malleable iron foundries are generally busy. The *Age of Steel* says: The St. Louis Malleable Iron Company have recently received several very large orders for gray iron, and for their malleable iron department have all the orders they can take care of until further improvements to their plant, now contemplated, are made. They expect to run every day and night this summer.

An item is going the rounds of the industrial journals mentioning that a lace factory is to be started at Wilksbarre, Pa., "which will be the only one of its kind in the United States." A manufactory of fine laces has been in successful operation in Brooklyn, N. Y., for several years. In the new lace factory it is proposed to give working men a chance to become stockholders in the company, and the shares have been placed at $100 each. The whole capital is to be $150,000.

The large engine, Superior, built by E. D. Leavitt, for the Calumet and Hecla Mining Company, Michigan, is running at about 60 revolutions per minute, and easily furnishing about 2,500-horse power. Its cylinders are 72 and 37 inches in diameter. Its main balance-band wheels are 32 feet 1 inch in diameter, and take a 32-inch belt. Its nominal capacity is 4,700-horse power, being the largest stationary engine in America. This engine was illustrated in detail in the AMERICAN MACHINIST of June 25 and July 2, 1881.

The North Chicago Rolling Mill Company reports the business for the first half of this year as exceeding by from 10 to 15 per cent. that of the last half of 1883, with indications of reasonably full work the present half year. The steel rail output is now from 1,000 to 1,200 tons a day; bar iron 100 tons, and nails 1,000 kegs. The production of pig is 1,000 tons daily, all of which is used by the company. The nail mill (at Milwaukee) was erected this year, and a plant for the manufacture of steel girders, beams, etc., is under way.

The *National Labor Tribune*, of Pittsburgh, says: The capacity of the works at Braddock's is 650 tons, and the daily output is now 300, all thirty-foot rails, each weighing 650 pounds. Within the last two weeks eighty men were discharged. Three new heating furnaces are now being built, and a train of a new kind of universal rolls is to be erected that will be manipulated by one man, doing away with two crews of roll hands and the laborers. The work of making rails can be accomplished with about forty men less.

The *Industrial South*, of Richmond, Va., says: There is a wood pulp factory at Augusta, Ga., at which the expedition with which paper could be manufactured was recently demonstrated. A tree was cut in the forest at six o'clock in the morning, was made into pulp and then into paper at six o'clock in the evening, and distributed among the people as a newspaper by six o'clock in the morning. From a tree in the forest to a printed newspaper, being read by thousands, in the brief round of twenty-four hours. This can be done easily.

Director-General Burke, of the World's Exposition, at New Orleans, has issued proposals for furnishing steam engines, boilers, shafting, etc. Proposals for engines will state diameter of cylinder, length of stroke, number of revolutions per minute, diameter and width of driving pulleys. It is estimated that 4,000-horse power will be required. Bidders are to state terms upon which they will furnish engines. Proposals for boilers will be for all or part of 4,500-horse power of the boilers. The other proposals will be for shafting, compression, coupling miter, and beveled gear, etc.

James Edwards & Co., of New York, builders of centrifugal pumps, are building a novel dredging machine for the Okeechobee Land and Improvement Company, to be used in draining the swamps of Southern Florida. It consists of a huge pump, mounted on a float, and driven by a direct-coupled Westinghouse engine of 125-horse power, making 300 turns per minute. At the outboard end of the suction pipe are a series of revolving knives, which stir up the sand and mud. These deposits, when in suspension, are sucked up by the powerful current and discharged over the dike. This plan has elsewhere proved very efficient.

The contract for the superstructure of the new bridge of the Baltimore and Ohio Railroad Company, over the Susquehanna river at Port Deposit, Md., has been let to the Keystone Bridge Company, of this city, says the Pittsburgh *Chronicle-Telegraph*. This bridge when completed will be the largest railroad bridge in the world. The length will be 6,830 feet. It was recently that the company commenced on a bridge for the Louisville and Nashville Railroad Company, to be located on the Ohio river at Hemlors, Ky. The total length of it will be 3,670 feet, consisting of fourteen spans, for which it will require 3,800 tons of steel and iron. The combined length of both bridges is 10,506 feet, or 54 feet less than two miles long, with a total weight of over 9,000 tons.

There is no little stir among the manufacturers at Paterson, N. J., over the new law that went into effect July 1, prohibiting the employment in any mill or factory of boys under twelve or girls under fourteen years of age, or of operatives of either sex between the ages of twelve and fifteen years who have not within the preceding twelve months attended school at least twelve consecutive weeks, proof of such attendance to be furnished employers by parents or guardians. It is estimated that there are in the Paterson mills and shops at least a thousand children who are not eligible under this law and who must be discharged at once if their employers would not be fined from $50 to $100 for each offence.—*The Textile Manufacturer.*

It is not every manufacturing establishment that can manage a farm as well as a shop. The Tanite Company, of Stroudsburg, Pa., we learn by a notice in a local paper (a copy of which the company sends us) is not only about to make a large extension to its factory, but is about to raise some new kinds of corn and rye. On the latter point the notice says: On its fields immediately adjoining the factory, the company continues its efforts, still considered experimental, in the culture of lima beans, and has in, this year, ten thousand five hundred hills (10,500), all of which promise better than at any past season. It is also raising several kinds of corn, new to this county, and intends to sow in the fall all of the new Thousand-Fold rye which it raised last year.

Among shipments of the Pratt & Whitney Company, of Hartford, during the month of June, the following are worthy of note: Lathes, cam cutters, screw machines, and milling machines, with fixtures and mills, to a large sewing machine company having factories in the United States and Great Britain; one 12″ crank shaper to R. Dudgeon, New York, N. Y.; one 18″ pattern-maker's lathe to Waterbury Clock Company, Waterbury, Conn.; two key seating machines to Yale & Towne Manufacturing Company, Stamford, Conn.; one 26″ upright drill and one 21″ engine lathe to a party in Germany; twist-drill grinding machines to parties in Kentucky and Pennsylvania; screw and bolt-heading machines to Port Chester Bolt and Nut Company, Port Chester, N. Y.; roll-grooving machine to George J. Fritz, St. Louis, Mo.; 48″ gear-cutting machine to Clem & Morse, Philadelphia, Pa.; 600 and 800 pounds drop hammers to parties in Ohio and New York, and a trimming press to Ohio.

Machinists' Supplies and Iron.

New York, July 17, 1884.

The supply business continues quiet.

In American iron the transactions are limited, the supply being rigidly held down to meet the demand, which is light. Hopes are entertained that a revival of demand for the fall trade will intervene soon. We quote No. 1 X Foundry, $20 to $20.50; No. 2 X $18 to $19; Grey Forge, $16 to $17.

Scotch pig meets with light demand, the importations being in excess of requirements. Prices are irregular, with a tendency in buyers' favor. We quote Shotts, $21 50 to $21.75, to arrive; Coltness, $21.50 to arrive, $22 yard; Glengarnock, $20 50 to arrive; Cambroe, $20.50; Langloan, $21; Dalmellington, $19.50.

Copper—The demand for ingot has ruled quiet, with little demand. Lake is quoted 14c. to 14¼c; other brands, 13c. to 13¼c.

Lead—The market has ruled dull and nominal, with sales mostly of a jobbing character at 3.55c.

Tin has ruled quiet and steady, with a moderate demand. We quote for jobbing lots Banca, 20¾c.; Straits and Malacca, 18¾c.

✲WANTED✲

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Experienced foreman in specialties of iron and brass. Address "Foreman," 59 Main street, Buffalo, N. Y.

Mechanical draughtsman, of sober habits and varied experience, wants position. Address B., American Machinist.

Wanted-An engagement, by an experienced mechanical draughtsman. Best of references as to ability. Address "Draughtsman," Box 235, Boston, Mass.

Wanted—Injector maker, a young man, for a steady position, in a Western city. Address S., Am. Machinist.

Wanted—A good machinist, capable of doing lathe and vise work. For particulars, write Walter S. McKinney, 13 N. Depot street, Binghamton, N. Y.

Wanted—Machine shop foreman used to first-class engine work. None except those who can give the best of references need apply. Address M. D. Leggett & Co., Cleveland, O.

Mechanical engineer and practical machinist, with large experience as superintendent and manager of a general foundry and machine business, is open to engagement. Address X., Am. Machinist.

Wanted—A foreman for a machine shop, in New England, employing twenty hands and making fine machinery. Address A. B. C., care Am. Machinist, stating experience and salary expected, with references.

First-class mechanical engineer and draughtsman, with extensive experience as designer, superintendent, and salesman, is open to an engagement. Steam engineering a specialty. Best of references. Address "M, 100," Am. Machinist.

A thoroughly educated mechanical engineer and draughtsman, well posted in steam engineering, desires an engagement enabling him to prove his worth Highest references from leading American and foreign shops. Has designed original machines for leading firms. Address "Box 15," Am. Machinist.

Wanted—A traveling salesman for the Chicago house of an Eastern manufacturing company. He should have, in addition to ability as a salesman, some knowledge of mechanical drawing, an aptitude for mechanics, and some familiarity with machinery; while his occupation will be principally selling a line of machinery, he will also be required to handle such other of the company's products as may be desired. Address, stating age, whether married, previous experience, salary expected, and references. C., office of Am. Machinist.

For Sale—Richards-Elliott indicator, in excellent condition, with five springs and scales. Address D. Ashworth, Second and Elm streets, Cincinnati, O.

Wanted—New engine, that will give 150-horse power with 40 lbs steam. Send cut, dimensions, and lowest cash figures to Salem Iron Works, Salem, North Carolina

Wanted—Parties traveling and selling to steam users, or dealing in mill supplies, to take the agency of a good and fast-selling article. Good inducements offered. Address "Manufacturer," care of Am. Machinist.

To Draughtsmen, Engineers, etc.—A complete set of detail working drawings of a horizontal steam engine cylinder 10″x18″, of the most modern construction, with double-ported balanced valve and adjustable main bearing. For price and particulars, address I. K. MacKenzie, 1831 Carpenter street, Philadelphia, Pa.

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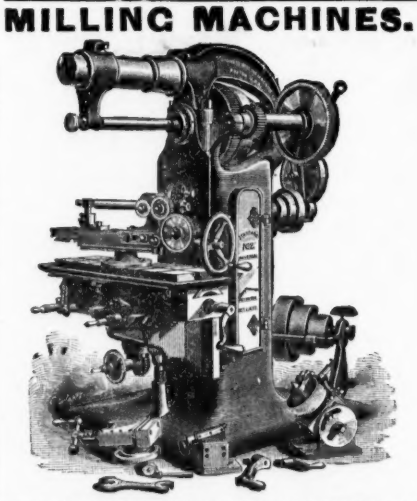

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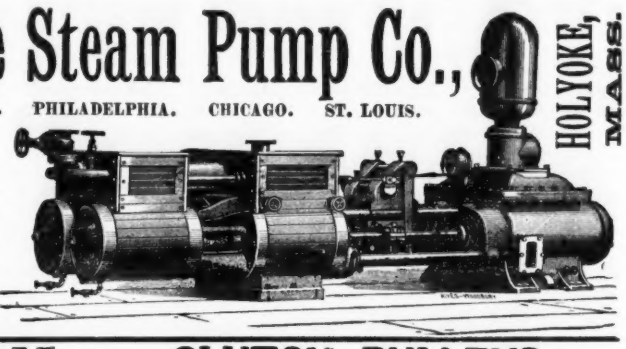

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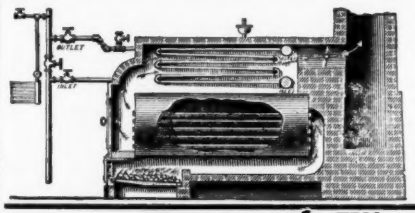

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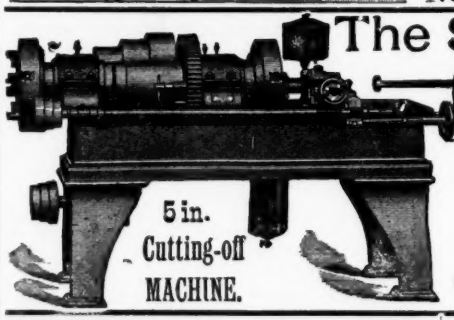

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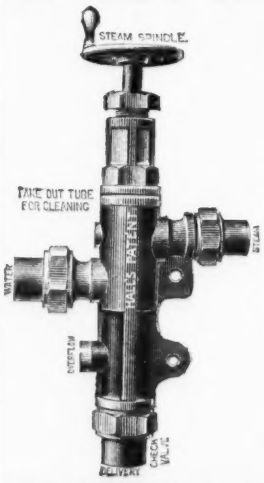

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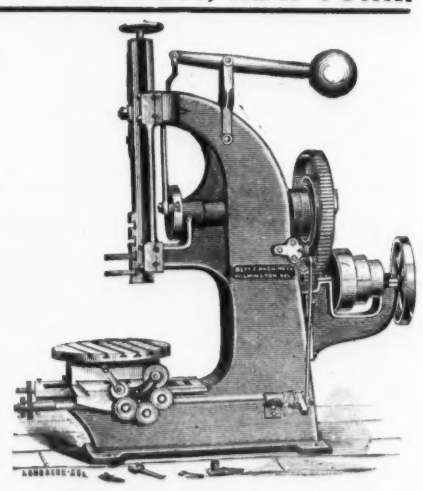

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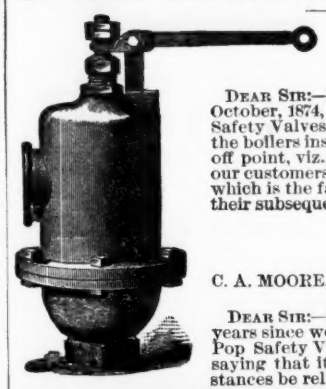

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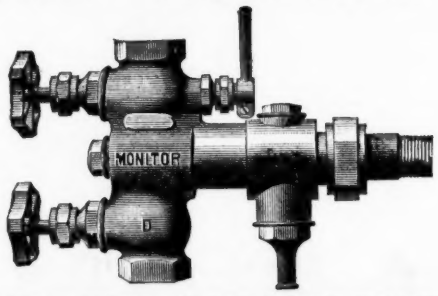

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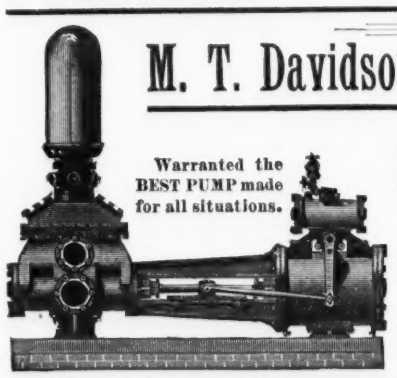

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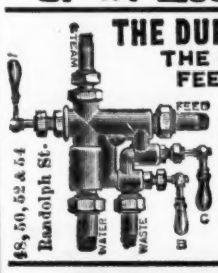

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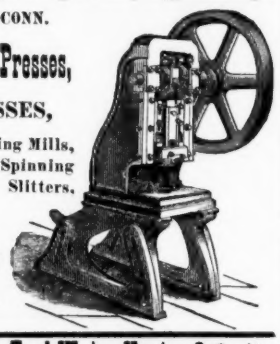

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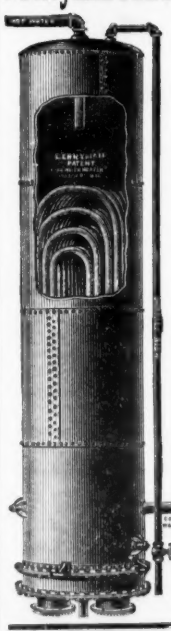

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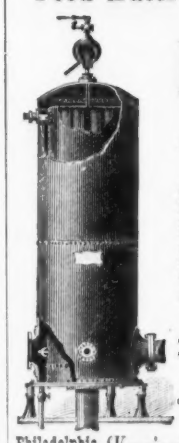

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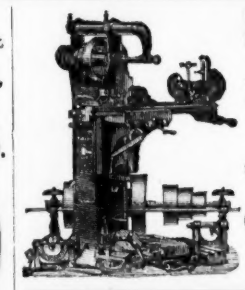

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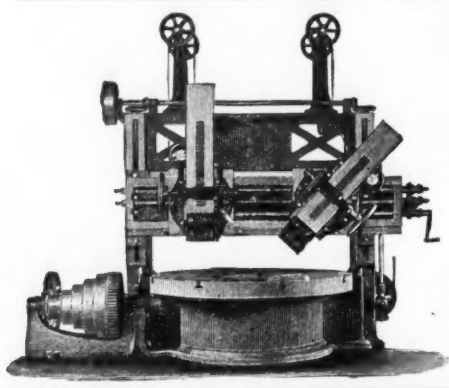

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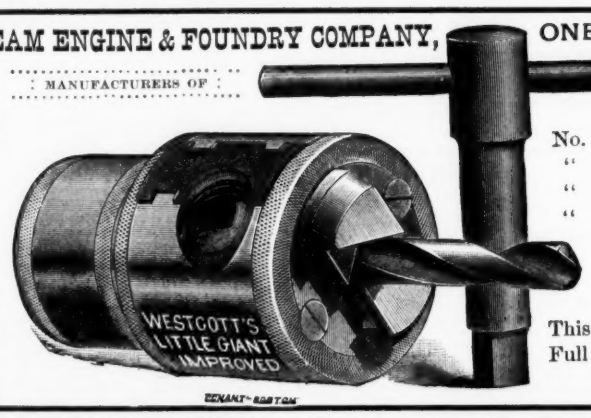

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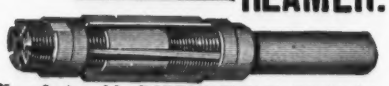

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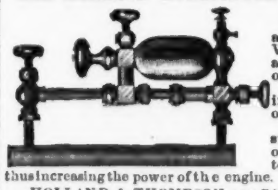

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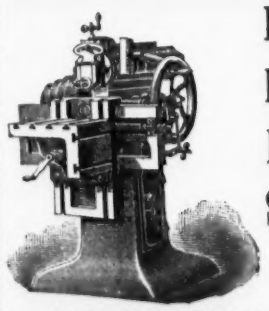

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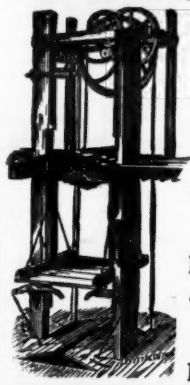

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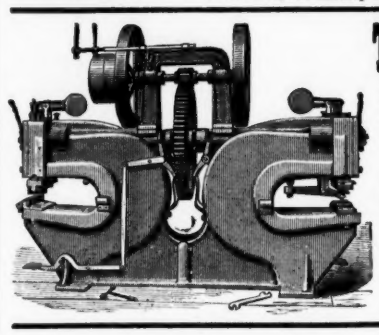

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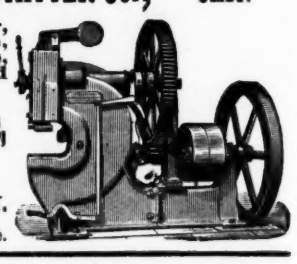

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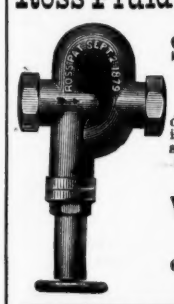

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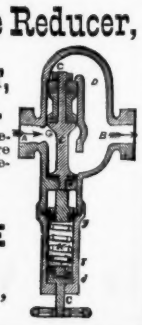

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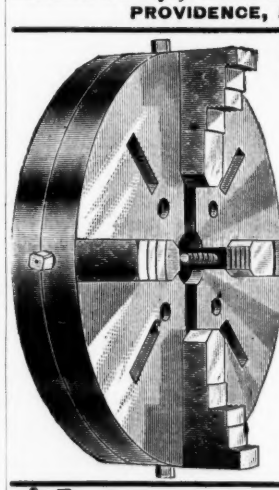

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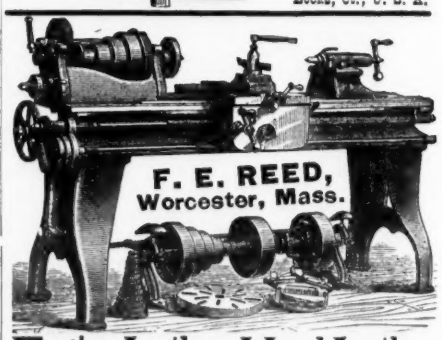

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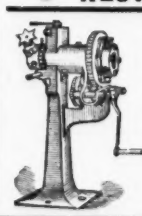

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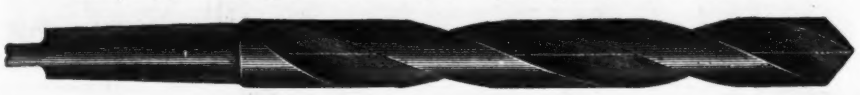

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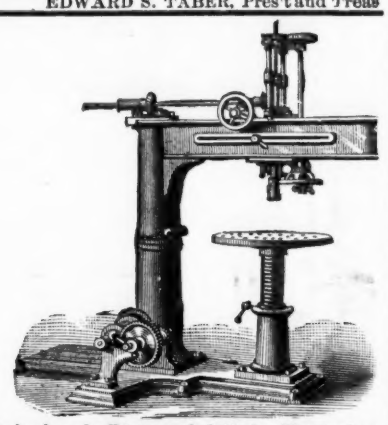

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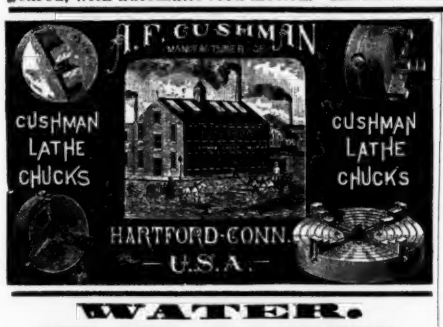

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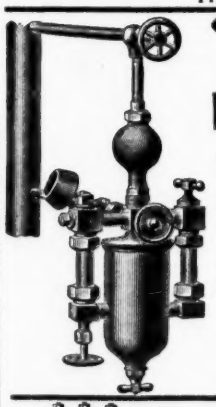

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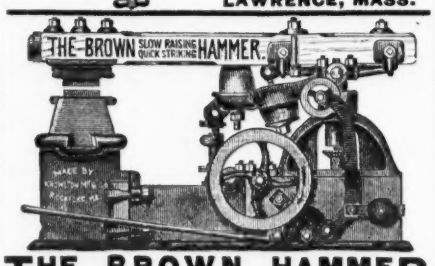

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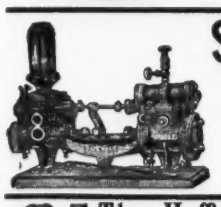

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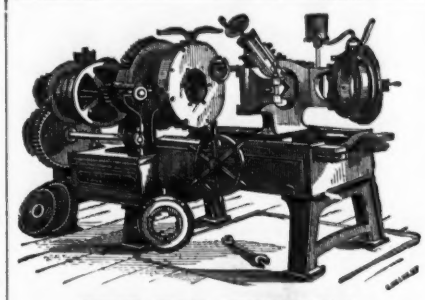

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For Pipe, Mill and Steam Fitters' Use.

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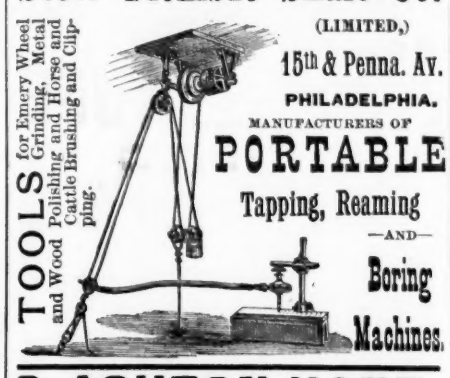

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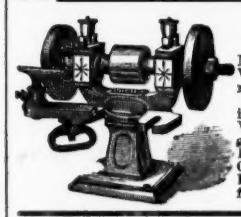

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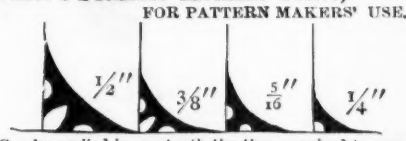

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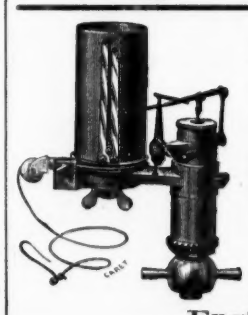

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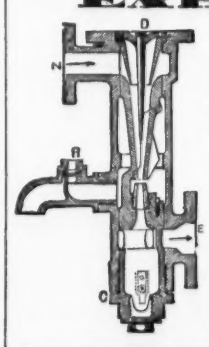

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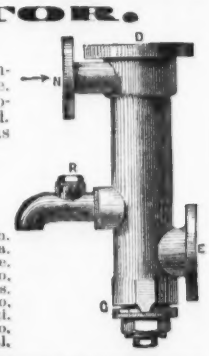

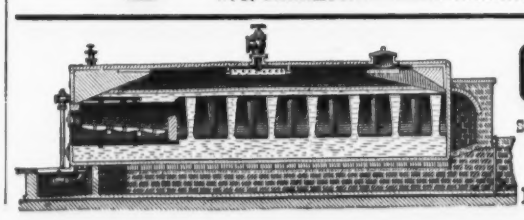

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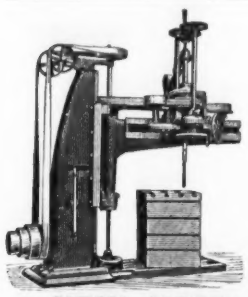

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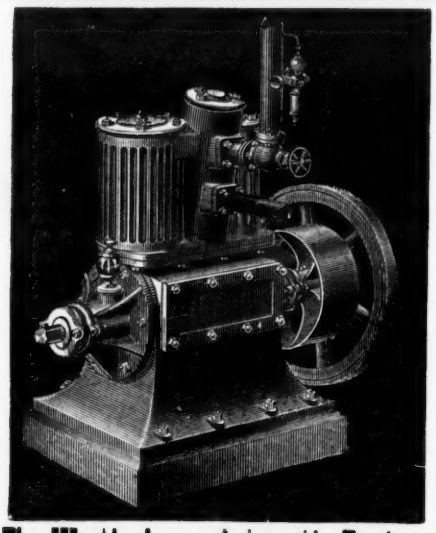

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The best evidence of its peculiar merit is the fact that our

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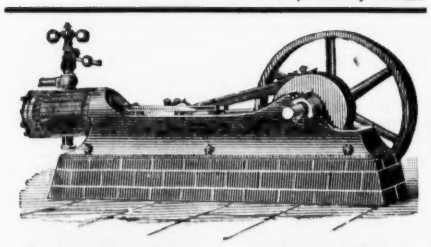

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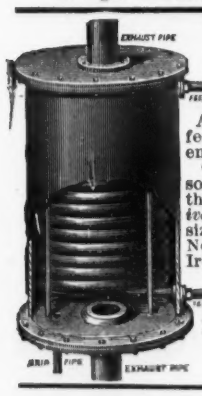

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A brass coil heater supplying feed water at 210° to 212° Fahrenheit by use of exhaust steam.

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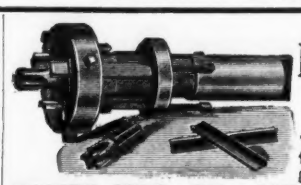

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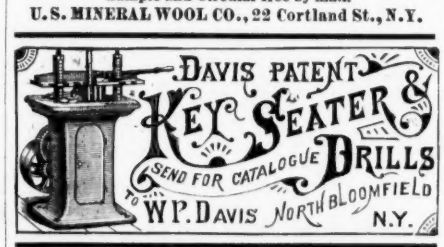

THE ALLIGATOR WRENCH,

Teeth cut diagonally, Grips Round Iron or Pipe.

PATENTED AUGUST 31, 1875.

Falcon Wrench.

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THE PUSEY & JONES CO.

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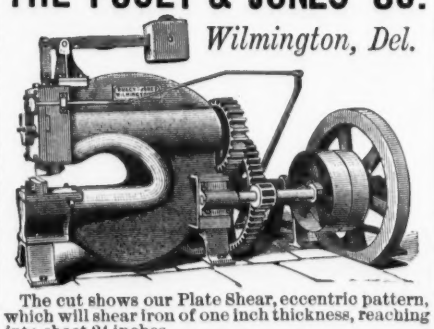

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guaranteed to excavate 50 per cent. more material from hard bottom than any other machine.

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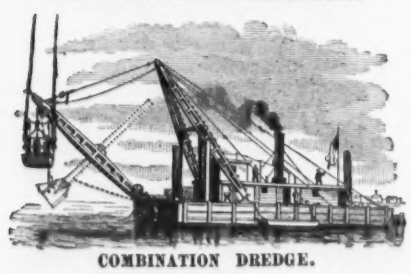

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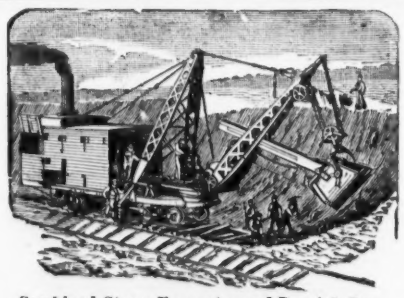

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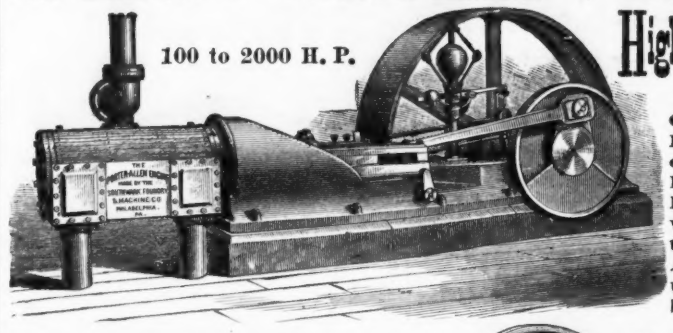

100 to 2000 H. P.

The Cambria Iron Co., Johnstown, Pa., has just ordered two Porter-Allen Engines of 400 H. P. and 500 H. P., which will make a total of 14 Porter-Allen Engines in use by that establishment.

Southwark Foundry & Machine Co.

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MANUFACTURERS OF

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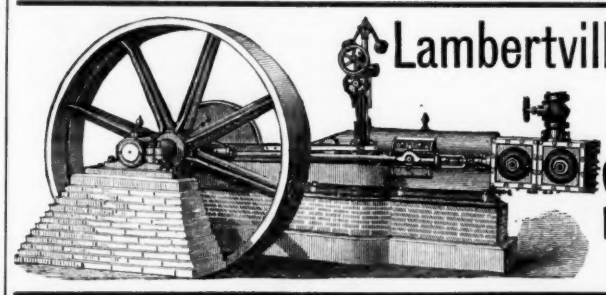
Steam Engines



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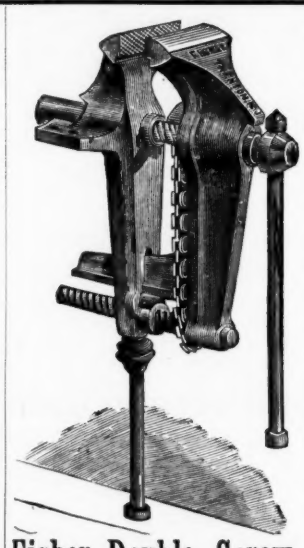

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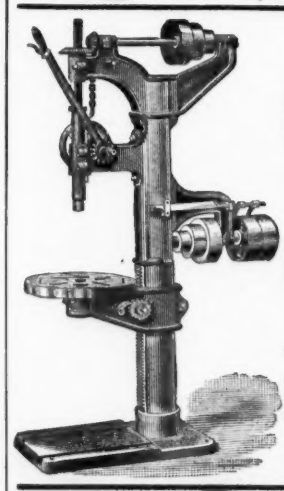

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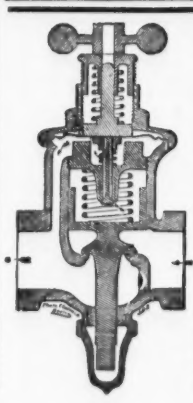

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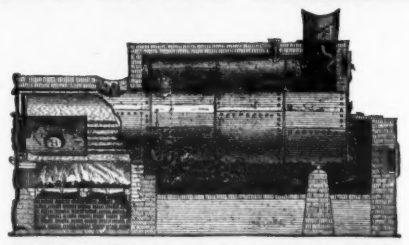

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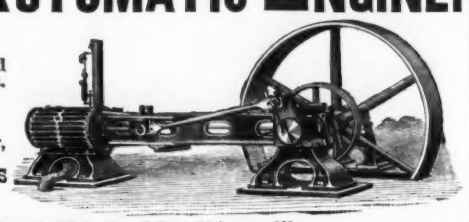

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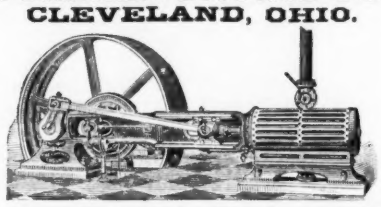

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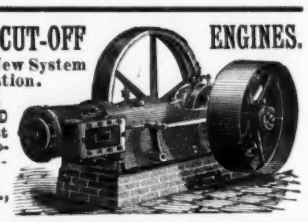

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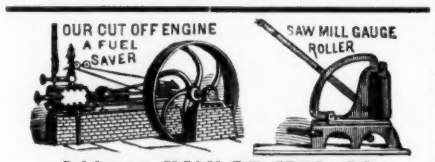

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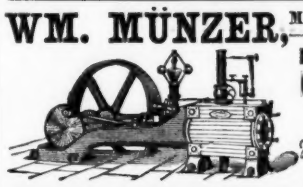

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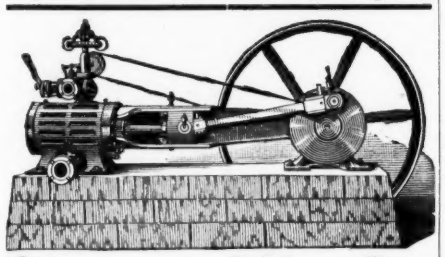

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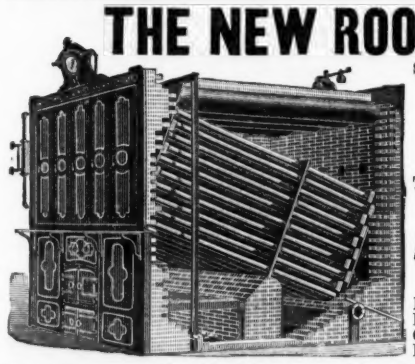

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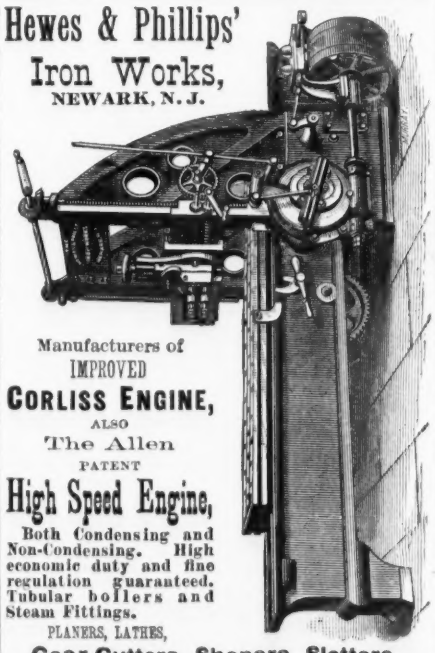

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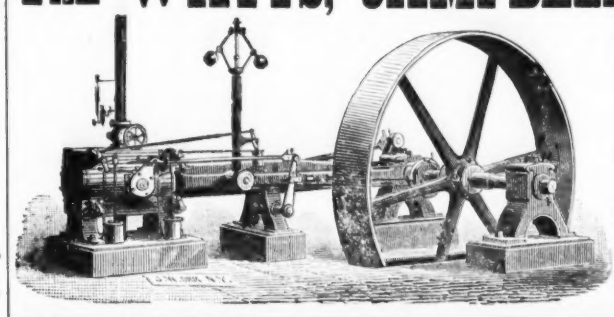

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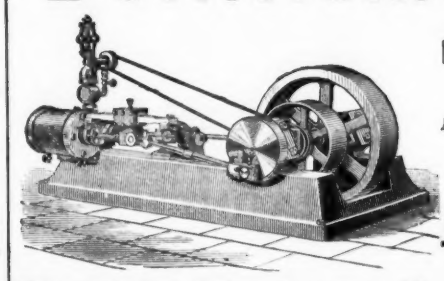

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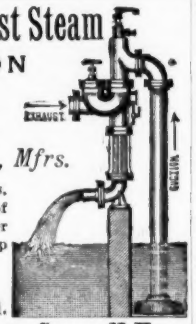

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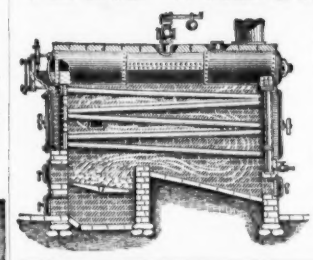

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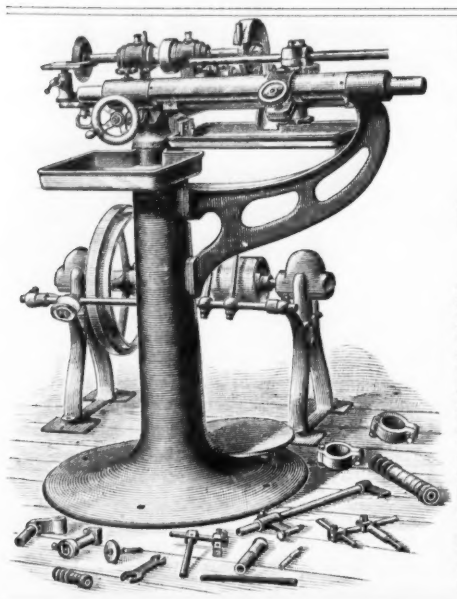

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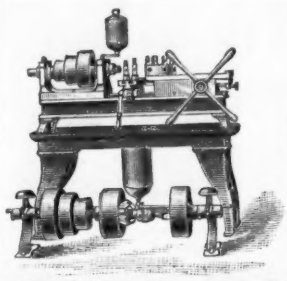

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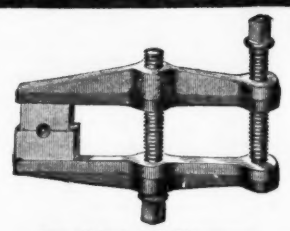

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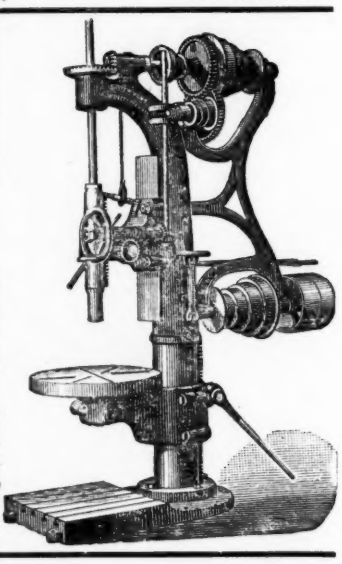

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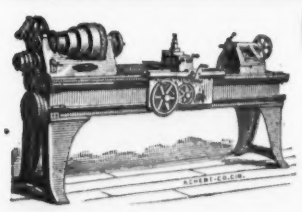

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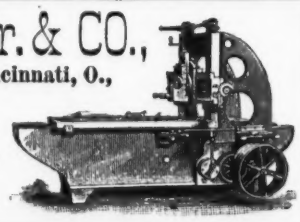

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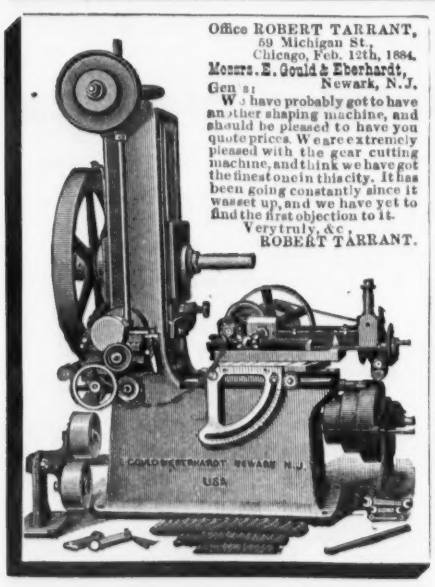

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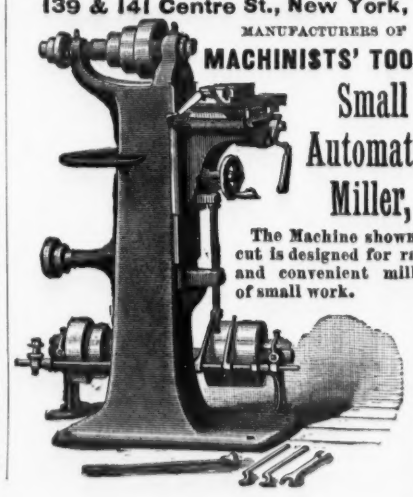

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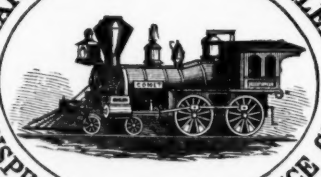

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The above are all our own make.

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Engine Lathes, Screw-Cutting—Three 18 in. Swing, 8 ft. bed, Lodge, Barker; two 16 in. Swing, 6 ft. bed, Ames & Perkins; one 12 in Swing, 5 ft. bed, Read; one 15 in. Swing, 5 ft. bed, B. G. Turret Lathe, Lodge, Barker.

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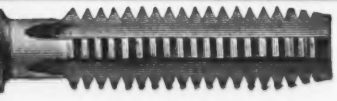

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